



CITY OF BREA

COMBUSTIBLE SOIL-GAS GUIDELINE

Updated 5-2020

PURPOSE

Combustible soil-gases, such as methane, can seep into structures and explode if a source of ignition is present when gases accumulate to an explosive concentration in a confined space. This represents a significant threat to public safety in areas where combustible soil-gases are present, or in structures where soil-gases may accumulate. Therefore, engineering controls should be designed, installed, and maintained in all occupied structures constructed in areas potentially impacted by combustible soil-gas.

The City of Brea is bounded on the south by the Coyote Petroleum Reservoir, and to the north by the Brea-Olinda Petroleum Reservoir. The Brea-Olinda reservoir is also associated with the Whittier Earthquake Fault Zone; characterized by vertical fractures in bedrock and oil and gas seeps at the surface. Because of these seeps, the Brea-Olinda reservoir is the second oldest (i.e., second discovered) petroleum reservoir in California, and seeps are still present today. Moreover, drilling and development within these two reservoirs resulted in hundreds of well casings being installed; some are known to leak and convey significant concentrations of methane gas to the surface. Development in the City is occurring over these reservoirs and seeps, and well casings are being encountered during the development process. In order to enhance Public Safety, the safety of Brea's residents purchasing new homes in these developments, and the safety of occupants working in new commercial buildings, appropriate measures shall be implemented by the City to mitigate soil-gas seepage (i.e., vapor intrusion) into structures being built over these petroleum reservoirs, i.e., the "Impacted Areas."

SCOPE

The California Department of Oil, Gas and Geothermal Resources (DOGGR) delineates areas of oil and gas production. Based on DOGGR maps, the City of Brea has distinct areas where oil production was, or is, occurring. In some areas, oil/gas wells are abandoned or idled, and in other areas, wells are still operating. There are also areas of the City where no known oil drilling/production took place. In areas where known oil facilities are or were present, a soil-gas investigation shall take place prior to new development being built, and appropriate mitigation measures shall be implemented if elevated concentrations of combustible soil-gas are present, or if operating oil facilities are nearby.

This ordinance applies to all occupied structures within the City of Brea that may experience soil-gas vapor intrusion. At this time, this ordinance only applies to new construction, including additions and remodels of existing structures. However, the City's Fire Chief may at any time, in the interest of enhancing Public Safety, require a building owner to mitigate soil-gas vapor intrusion at any occupied structure experiencing potentially dangerous concentrations of combustible soil-gas therein.

COMBUSTIBLE SOIL-GAS ORDINANCE

The City's Combustible Soil-Gas Ordinance is divided into five parts, and includes:

PART I – Combustible Soil-Gas Investigation

PART II – Combustible Soil-Gas Mitigation

PART III – Combustible Soil-Gas Monitoring

PART IV – Maintenance of Soil-Gas Mitigation Systems

PART V – Long-Term Funding of Combustible Soil-Gas Systems

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PART - I

COMBUSTIBLE SOIL-GAS INVESTIGATION

AREAS IMPACTED BY COMBUSTIBLE SOIL-GAS

As mentioned in the Purpose of this Ordinance, significant areas within the City of Brea, as well as adjacent areas of un-incorporated Orange County that may be annexed by the City of Brea, overlie two petroleum-bearing formations (herein collectively referred to as: “the petroleum reservoirs”). These areas are known to have substantial concentrations of methane gas present in the soil.

The petroleum reservoirs, and well casings, are depicted in Figure No. 1 – shown at the end of Part 1; which has been obtained from the California Department of Oil, Gas, and Geothermal Resources (DOGGR). All property overlying these reservoirs, as depicted by DOGGR, including all property within 300-ft of a reservoir’s boundary, shall be considered as being potentially impacted by combustible soil-gas, and shall be subject to the most current City of Brea Combustible Soil-Gas Mitigation Requirements. Herein, these areas are referred to as the “Impacted Areas.”

NOTE - For parcels that do not fully lie within a combustible soil-gas impact area (shown in RED in Figure No. 1) and with only a portion of the parcel within an Impacted Area, the entire parcel shall be subject to the City’s Soil-Gas Ordinance and mitigation requirements when developed.

SOIL-GAS INVESTIGATIONS

All property that lies wholly or partially within a combustible soil-gas Impact Area, is required to have a comprehensive soil-gas investigation, subject to the following:

- The City Fire Department may require soil-gas investigations for any new development within the City’s jurisdiction, regardless of its location relative to the RED area in Figure No. 1. This includes but is not limited to properties formally containing storage tanks, surface impoundments containing petroleum products (e.g. crude oil, condensate, oil-waste water, refined products, etc.)
- A combustible soil-gas investigation shall be conducted for all projects that are located within, or adjacent to, an Impacted Area where known oil/gas operations have been and/or are in existence, or areas known or suspected of being impacted by combustible soil-gas.
- All soil-gas investigations shall conform to the most current City of Brea Fire Department requirements and guidelines.
- Soil-gas investigations cannot be conducted within 60-days of any mass-grading or excavation activities, or within 30-days of any light grading/excavation activities.
- Soil-gas investigations shall be conducted below “Blue-line Grade” elevations.
- Soil-gas investigation shall be conducted using temporary, dual-completion, soil-gas probes.
- Soil-gas investigations shall include a records survey of adjacent areas/properties that are within 300-feet of the Project’s boundaries and suspected of being impacted by combustible soil-gas.

SOIL-GAS INVESTIGATION PLAN

A **Soil-Gas Investigation Plan** shall be developed and submitted to the City Fire Department for review and approval prior to conducting a soil-gas investigation, installing soil-gas probes, or collecting soil-gas data. **EXCEPTION** - Property due-diligence efforts can occur at any time, however, soil-gas data collected for due diligence purposes that was not collected in accordance with a City-approved **Soil-Gas Investigation Plan**, may not be accepted by the City Fire Department for purposes of granting site development, grading, or building permits.

At its discretion, the City may require a third-party review of **Soil-Gas Investigation Plans** submitted for the City's approval. All soil-gas investigations conducted in the City shall be performed in accordance with criteria so stated in the next section.

SOIL-GAS INVESTIGATION CRITERIA

Soil-gas investigations differ for residential development versus commercial development, with one notable exception, i.e., all high-occupancy commercial, critical care and/or institutional developments shall follow all criteria established for residential development in lieu of criteria established for commercial development.

Residential soil-gas investigations must include the following:

- Soil-gas probes must be installed at a frequency of one per 5,000-sq.ft of Project area, or one per residential parcel, whichever is less,
- For each Project area, a minimum of three soil-gas probes must be installed, and
- In each location where a well casing exists AND where that well casing will be covered with hardscape (i.e., concrete or asphalt) or the well casing is within 50 feet of a structure, four (4) soil-gas probes must be installed, each equally spaced 10-ft from the well casing and 10-ft apart. In all other locations, two (2) soil gas probes shall be installed; one on either side of the well and 10-ft from the well.

Commercial soil gas investigations must include the following:

- Soil-gas probes must be installed at a frequency of one per 10,000-sq.ft, or one per parcel, whichever is less,
- For each Project area, a minimum of three soil-gas probes must be installed, and
- In locations where a well casing exists, two (2) soil-gas probes must be installed, each equally spaced around the well and 10-ft from the well
- **EXCEPTION** – If the developer proposes to place a structure over the well casing, then soil-gas probe spacing for well casings must follow all criteria establish for residential structures, i.e., four soil-gas probes must be equally located around the well casing.

All soil gas investigations must include the following:

- Soil-gas probes shall be temporary, dual-completion probes with porous sample tips placed at 10-ft and 20-ft below “blue-line” grade elevations. An example of a City pre-approved temporary soil-gas monitoring probe is shown in Figure No. 2 – shown at the end of Part 1.
- Within 48-hours of constructing a soil-gas probe, at least two air volumes of the sand-pack shall be removed and purged, and probe sampling (monitoring) may occur 24-hours later.

- *Characterizing soil-gas samples shall be immediate, i.e., without purging, with the highest concentration of soil-gas chemicals-of-concern recorded as well as the steady-state concentration. Note - In order to limit the influence of atmospheric intrusion, no more than two-purge volumes shall be extracted from the sand-pack prior to recording the steady-state concentration.*
- Soil-gas probes shall be sampled (monitored) on four occasions, no less than seven (7) days (one week) apart, and during periods of falling (not rising) barometric pressure.
- Prior to sampling soil-gas probes for chemicals, they shall be monitored for pressure. Pressure sensing equipment shall be capable of detecting pressure differentials as low as:
 - 0.1-in of water column, or 25-Pascals.
- Soil-gas shall be characterized with equipment capable of detecting total hydrocarbons as methane, hydrogen sulfide, carbon dioxide, and oxygen. Chemical detectors shall be capable of a precision of:
 - (+/-) 50-parts per million by volume (ppm/v) for hydrocarbons,
 - (+/-) 1-parts per million by volume (ppm/v) for hydrogen sulfide, and
 - (+/-) 0.1-percent by volume (%v) for carbon dioxide and oxygen.
- In lieu of using field equipment, soil-gas samples can be collected in clean air-tight containers and submitted to a California-certified analytical laboratory for analysis of total hydrocarbons as methane, hydrogen sulfide, carbon dioxide and oxygen with similar precision as stated above. Laboratory analysis must occur within 24-hrs for samples collected in bags (e.g., Tedlar) and 72-hrs for samples collected in canisters (e.g., SUMMA).

SOIL-GAS INVESTIGATION REPORTS

Reports of all soil-gas investigations submitted to the City shall include the following:

- Site map (drawing) showing locations of soil-gas probes with respect to relevant site features, proposed development (roads, buildings, hardscape features, etc.), known petroleum-related wells both on-site and wells within 300-ft of the site, known seeps and/or stained soil, etc.
- Logs of soil-gas probes showing depth of installation and construction details.
- Data shall be submitted to the City in a tabular format that includes: date, time, and the name of the technician collecting the data, chemical content of the soil-gas, soil-gas pressure, pre- and post-sampling barometric pressure, sample method, detector used, calibration certification verifying equipment operation and precision, etc.
- Data and recommendations shall be certified with a “wet” signature and stamp by a Professional Engineer licensed in California and who is experienced in combustible soil-gas mitigation.

SUBSEQUENT SOIL-GAS INVESTIGATIONS

In the event that any soil-gas data indicates that concentrations of chemical constituents in the soil-gas have not normalized after four rounds/periods of monitoring, the City may request and require additional soil-gas monitoring, one week apart, until data has stabilized; thus indicating that equilibrium conditions have been achieved.

In the event that any soil-gas data indicates concentrations/pressures of soil-gas approaching:

- 2.5-%v (percent by volume) methane, or
- 1-%v methane and 5-%v carbon dioxide, or
- Sub-surface pressures at 20ft-BGS that exceed 0.5inWC (125Pa)

the City may require subsequent additional soil-gas investigations, including but not limited to: the installation of additional soil-gas probes, probes spaced closer together and/or deeper probes. If so requested by the City, this effort must be performed pursuant to a supplemental or amended **Soil-Gas Investigation Plan** that is submitted to, and reviewed and approved by, the City. This subsequent investigation will be for purposes of identifying soil-gas seepage zones where additional mitigation measures (e.g., sub-grade soil-gas collectors) may be necessary to enhance Public Safety.

THRESHOLDS WARRANTING SOIL-GAS MITIGATION

The following thresholds will determine the level of soil-gas mitigation in the Project area:

MINIMAL MITIGATION THRESHOLD

- All soil-gas methane data is less than 1,000-ppmv,
- All soil-gas carbon dioxide data is less than 5-%v,
- All soil-gas sub-surface pressures are below 0.5-inWC (125-Pa), and
- No well casings on the Project site or within 300-ft of the Project site.

MODERATE MITIGATION THRESHOLD

- All soil-gas methane data is less than 5,000-ppmv,
- All soil gas carbon dioxide data is less than 10-%v,
- All soil-gas sub-surface pressures are below 0.5-inWC (125-Pa),
- No well casings covered by hardscape,
- No well casings within 50-ft of a structure, and
- No known combustible gas seepage zones within 300-ft of the Project area.

FULL MITIGATION THRESHOLD

- All soil-gas methane data is less than 25,000-ppmv,
- All soil-gas carbon dioxide data is less than 10%v,
- All soil-gas sub-surface pressures are below 1.0-inWC (250-Pa)
- No well casings under any structure, and
- No known combustible gas seepage zones within 300-ft of a structure.

SUBSTANTIAL MITIGATION THRESHOLD

- Substantial mitigation will be required where soil-gas data exceeds the maximum values allowed under **Full Mitigation** and/or where well casings are located under a structure. For these Projects, the City will consider mitigation measures on a case-by-case basis, and the City may request additional investigation and/or mitigation (i.e. additional engineering controls) for purposes of enhancing Public Safety. At a minimum, all the elements required for **Full Mitigation** shall be required.

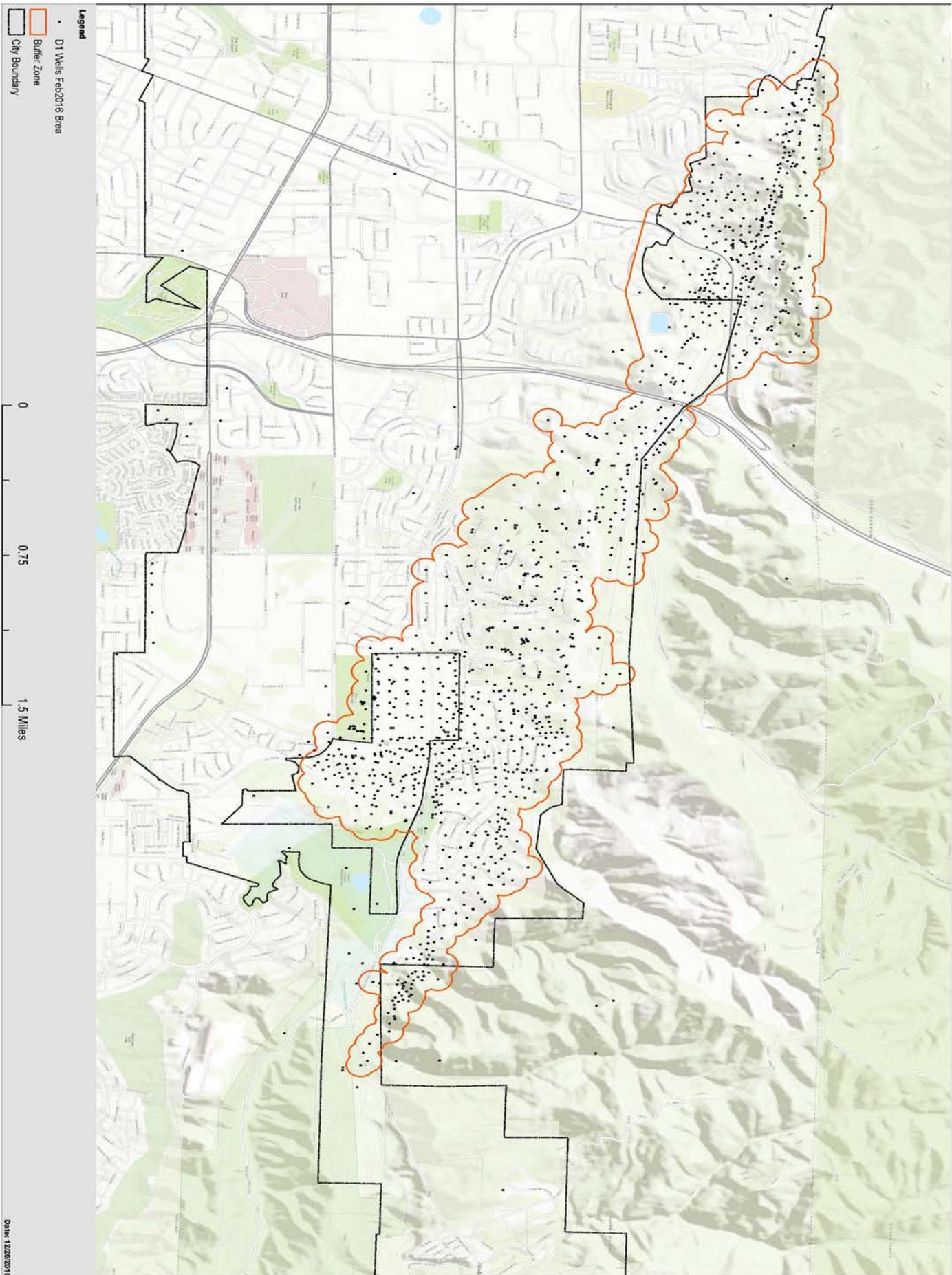
COMBUSTIBLE SOIL-GAS ANOMALY – Is defined as an area that has concentrations of combustible soil-gases (i.e., total combustible hydrocarbons as methane) exceeding 5,000-ppmv or soil-gas with carbon dioxide concentrations exceeding 5-% v.

COMBUSTIBLE SOIL-GAS SEEPAGE ZONE – Is defined as an area that has concentrations of combustible soil-gases (i.e., total combustible hydrocarbons as methane) exceeding 25,000-ppmv.

EXCEPTION – In some locations within an impacted area (as defined by Figure No. 1), the **Soil-Gas Investigation** may be omitted if the proposed development is constructed to include all elements associated with **Full Mitigation** (as mentioned in Part II) AND a request to do so is submitted for the City Fire Department’s review and approval AND that request is subsequently granted prior to requesting construction permits. **NOTE:** This exception is not applicable in locations with known or suspected oil or soil-gas seepage. In these locations, further delineation of seepage zones, and the magnitude thereof, is required.



Brea Methane Zone



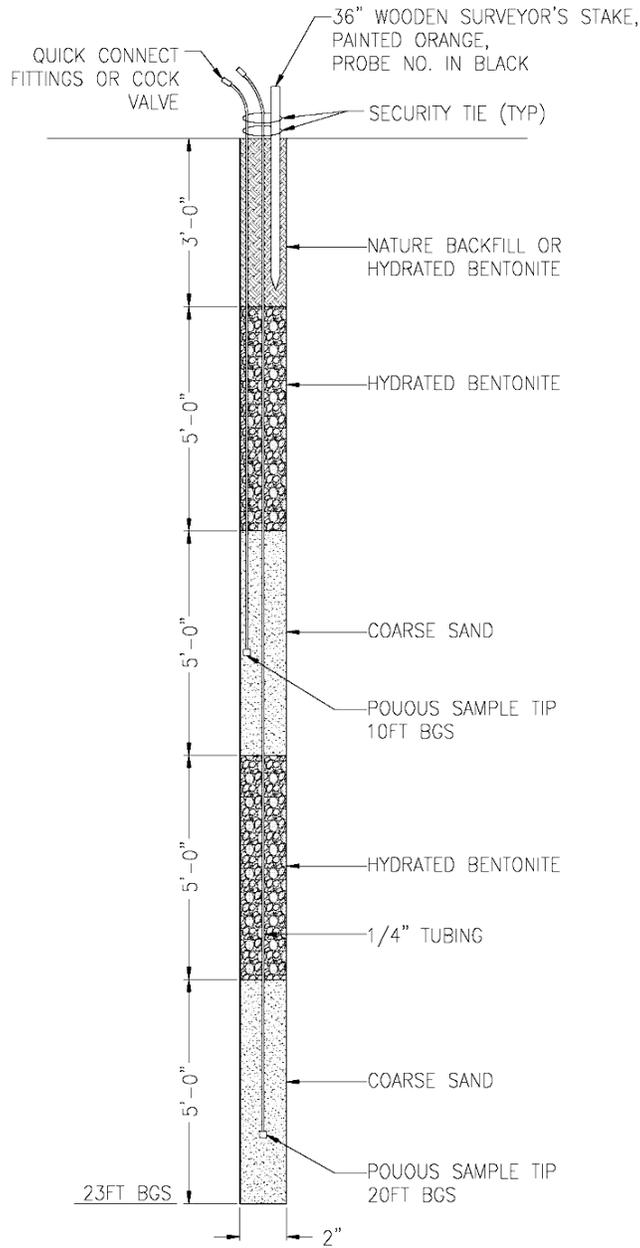


FIGURE No. 2 – SAMPLE Temporary Soil-Gas Monitoring Probe

PART - II

COMBUSTIBLE SOIL-GAS MITIGATION

GENERAL REQUIREMENTS

All new developments within the City of Brea Fire Department’s jurisdiction that are included in areas known or suspected to be impacted by combustible soil-gas (i.e., Impacted Areas) will require at least the minimum criteria for combustible soil-gas mitigation, regardless of soil-gas concentrations, and shall be subject to the following:

- All combustible soil-gas mitigation systems shall be designed and installed in conformance with the most current version of City of Brea’s Combustible Soil-Gas Ordinance and mitigation requirements.
- Under special circumstances, the City’s Fire Chief may require more, or less, stringent mitigation measures as deemed appropriate for protecting public safety.
- All combustible soil-gas mitigation systems shall be designed and installed in accordance with plans submitted, reviewed, and approved by the City’s Fire Department.
- At its discretion, the City may request a third-party review of combustible soil-gas mitigation designs/plans submitted to the City.
- All Combustible soil-gas mitigation systems installed by others shall be subject to inspection by City inspectors, moreover, systems shall be subject to the approval of City inspectors.
- At its discretion, the City may use qualified third-party inspectors to monitor the installation and/or testing of combustible soil-gas mitigation systems.
- The City Fire Department must receive at least forty-eight (48) hours notice prior to any of the following activities:
 - Completion of below-grade mitigation elements, and prior to covering said systems.
 - Installation and/or application of membrane barrier materials.
 - Testing of membrane barrier materials
 - Completion of passive vent systems inside buildings, and prior to covering said systems.

At a minimum, City inspectors must be provided with the opportunity to observe all combustible soil-gas mitigation elements prior to covering the elements from view.

- The City Fire Department may, at any point in the project, require additional submittals of plans, detailed drawings, specifications, data, reports, or any other such records/materials as may be necessary in order to ensure that all combustible soil-gas mitigation system elements comply with City requirements and guidelines.
- All combustible soil-gas mitigation systems plans shall be designed, “wet” signed and stamped by a Professional Engineer registered and licensed in the State of California with at least five (5) years experience specifically related to the field of combustible soil-gas mitigation. Said engineer shall have at the time of design submittal, comprehensive general liability insurance and professional errors and omissions insurance suitable to the City.

- To be considered for review and approval, all plans shall submitted by the Methane Mitigation Engineer, to the City, with an original “wet” signature and stamp.

THRESHOLDS FOR SOIL-GAS MITIGATION

Based on data collected during the soil-gas investigation, the threshold for structure protection, i.e., combustible soil-gas mitigation, shall be as follows:

MINIMAL MITIGATION THRESHOLD

- All soil-gas methane data is less than 1,000-ppmv,
- All soil-gas carbon dioxide data is less than 5-%v,
- All soil-gas sub-surface pressures are below 0.5-inWC (125-Pa), and
- No well casings on the Project site or within 300-ft of the Project site.

Minimal mitigation shall include all of the following:

- Two layers of common 6-mil black polyethylene as a vapor-reducing barrier under all foundation slabs, overlying soil that is free of all un-necessary penetrations.
- Each layer of plastic sheeting shall be 50% overlapped with all seams, joints and penetrations well taped and sealed.
- The vapor-reducing barrier must be protected from un-necessary penetration from reinforcing steel, stakes, foot traffic, tools, Dobie-blocks, etc.
- Monolithic concrete pour of all slabs
- All penetrations/voids in slabs sealed with an expanding 50-yr foam.

MODERATE MITIGATION THRESHOLD

- All soil-gas methane data is less than 5,000-ppmv,
- All soil gas carbon dioxide data is less than 10-%v,
- All soil-gas sub-surface pressures are below 0.5-inWC (125-Pa),
- No well casings covered by hardscape,
- No well casings within 50-ft of a structure, and
- No known combustible gas seepage zones within 300-ft of the Project area.

Moderate mitigation shall include all of the following:

- Below-grade passive venting (as described below) equally spaced under all foundation slabs with centrally-located vent risers.
- Vapor impermeable membrane (as described below) over the passive venting and under all foundation slabs and sealed to footings.
- Utility dams (as described below) at the edge of all foundations.

- Monolithic concrete pour of all slabs.
- All penetrations/voids in slabs sealed with an expanding 50-yr. foam.

FULL MITIGATION THRESHOLD

- All soil-gas methane data is less than 25,000-ppmv,
- All soil-gas carbon dioxide data is less than 10% v,
- All soil-gas sub-surface pressures are below 1.0-inWC (250-Pa)
- No well casings under any structure, and
- No known combustible gas seepage zones within 300-ft of a structure.

Full mitigation shall include all of the following:

- Below-grade passive venting (as described below) equally spaced under all foundation slabs with multiple vent risers.
- Vapor impermeable membrane (as described below) under all foundations.
- Utility dams (as described below) at the edge of each foundation and throughout Project area.
- Post-tension reinforcement and monolithic concrete pour of all concrete foundations and slabs.
- All penetrations/voids in slabs sealed with an expanding 50-yr. foam.
- Wye-seals in all dry utilities.

SUBSTANTIAL MITIGATION THRESHOLD

Substantial mitigation will be required where soil-gas data exceeds the maximum values identified under **Full Mitigation** and/or where well casings are located under a structure. For these Projects, the City will consider mitigation measures on a case-by-case basis, and the City may require additional mitigation elements for purposes of enhancing public safety. At a minimum, all of the elements required for **Full Mitigation** (mentioned above) will be required. Other elements may also be required by the City, which may include, but are not limited to:

- Soil-gas collectors deep below the occupied structures with separate, dedicated vent risers; herein referred to as “**Bottoms Mitigation.**”
- Water intercept drains to mitigate water collecting in deep soil-gas collectors; also referred to as “Bottoms Mitigation.”.
- Soil-gas collectors under all hardscape and spaced 50-ft center-to-center throughout the area covered by hardscape, and plumbed to separate, dedicated vent risers.
- Soil-gas collectors located around the building’s perimeter footing.
- Specifically engineered fill soils compacted to at least 95% relative compaction under foundations to limit upward migration of the soil-gas.
- Utility dams at a more frequent spacing, i.e., less than 300-ft.
- Permanent soil-gas monitoring probes, which will include developing a written soil-gas **Monitoring Plan**, periodic data reporting to the City Fire Department in the form of a

Monitoring Report, and a permanent funding source for routine and periodic monitoring of soil-gas and maintenance of mitigation systems, including data review and response actions by the City Fire Department.

- Retention of an experienced Environmental Coordinator or Methane Engineer who is experienced in the field of combustible soil-gas mitigation, who will oversee the monitoring and maintenance of soil-gas mitigation systems, and who has general liability and professional errors and omissions insurance suitable to the City.
- Active sensor (methane) systems in below-grade, occupied spaces.

MITIGATION PLAN SUBMITTALS

COMBUSTIBLE SOIL-GAS MITIGATION SYSTEM DESIGNS

- The City of Brea Fire Department shall approve all plans and designs for soil-gas mitigation systems and protective elements.
- All soil-gas mitigation system designs and plans shall conform to the most current City of Brea requirements and guidelines.
- At its discretion, the City may conduct a third-party review of combustible soil-gas mitigation designs/plans submitted to the City.
- All combustible soil-gas mitigation systems shall be designed, “wet” signed and stamped, by a Professional Engineer, adequately insured and properly licensed in the State of California with at least five (5) years’ experience in the field of combustible soil-gas mitigation.
- All plans submitted to the City Fire Department shall include five (5) copies of said plans and one (1) electronic archive copy in PDF format.
- Horizontal construction shall **NOT** begin on the Project site until all combustible soil-gas plans have been submitted, reviewed **and** approved by the City.
- All technologies, materials and methods used in the installation of combustible soil-gas mitigation systems elements shall reflect the most current industry standards of care and professional practice.
- A sample of a combustible soil-gas mitigation design for a detached single-story, residential home is shown as Figure No. 4.

COMPOSITE PLANS

All combustible soil-gas mitigation designs shall include **Composite Plans** that shall contain the following:

- Configuration of all streets within the Project area, complete with street names.
- Structure footprints identified by lot number.
- Locations of all existing well casings (e.g., operational, idled, abandoned and dry (exploratory) holes) inside the Project area **AND** all wells within 300-ft of the Project area.
- Locations of all soil-gas monitoring probes used to collect pre-construction soil-gas data.

- Locations of all soil-gas anomalies and soil-gas seepage zones, i.e., locations where combustible soil-gas was detected at concentrations exceeding 5,000-ppmv and 25,000-ppmv, and carbon dioxide was detected at concentrations exceeding 5-%v and 10-%V, respectively.
- Location of all permanent soil-gas monitoring wells; if warranted
- Locations of all utility dams; if warranted
- Location of all well casing vents and vent piping; if warranted
- Locations of all flagpole vents and vent piping.
- Locations of all “**BOTTOMS MITIGATION**” system elements, if warranted, including:
 - System drains, pipes and vaults.
 - Sub-drain collectors, piping and vaults.
 - Sub-drain system vents and vent piping routed to structures.
 - Flow direction for all sub-drain system piping; both liquid and vapor elements.
- Include a legend using standard symbols on all plans.

In addition, the following is relevant to **Composite Plans**:

- A preliminary **Draft-Composite Plan** shall be submitted to the City along with all combustible soil-gas mitigation designs submitted to the City for review and approval.
- The preliminary **Draft-Composite Plan** shall be periodically updated as new information becomes available that is relevant to combustible soil-gas mitigation at the Project site.
- A final **Composite Plan**, with as-built information, shall be submitted for the City’s review AND it must be approved prior to any Certificates of Completion and/or Certificates of Occupancy being issued by the City.
- At its discretion, the City may require a third-party to review and/or field-verify information contained on **Composite Plans** (submitted to the City) prior to the City approving said plans.

An example of a portion of a **Composite Plan** is shown in Figure No. 3.

MITIGATION SYSTEM REQUIREMENTS

GENERAL REQUIREMENTS

- All mitigation systems shall conform to the current City requirements and guidelines.
- At the City’s discretion, mitigation systems shall be subject to third-party review and/or inspection.
- The City Fire Chief may require additional soil-gas investigations and/or mitigation measures as deemed necessary to enhance Public Safety.

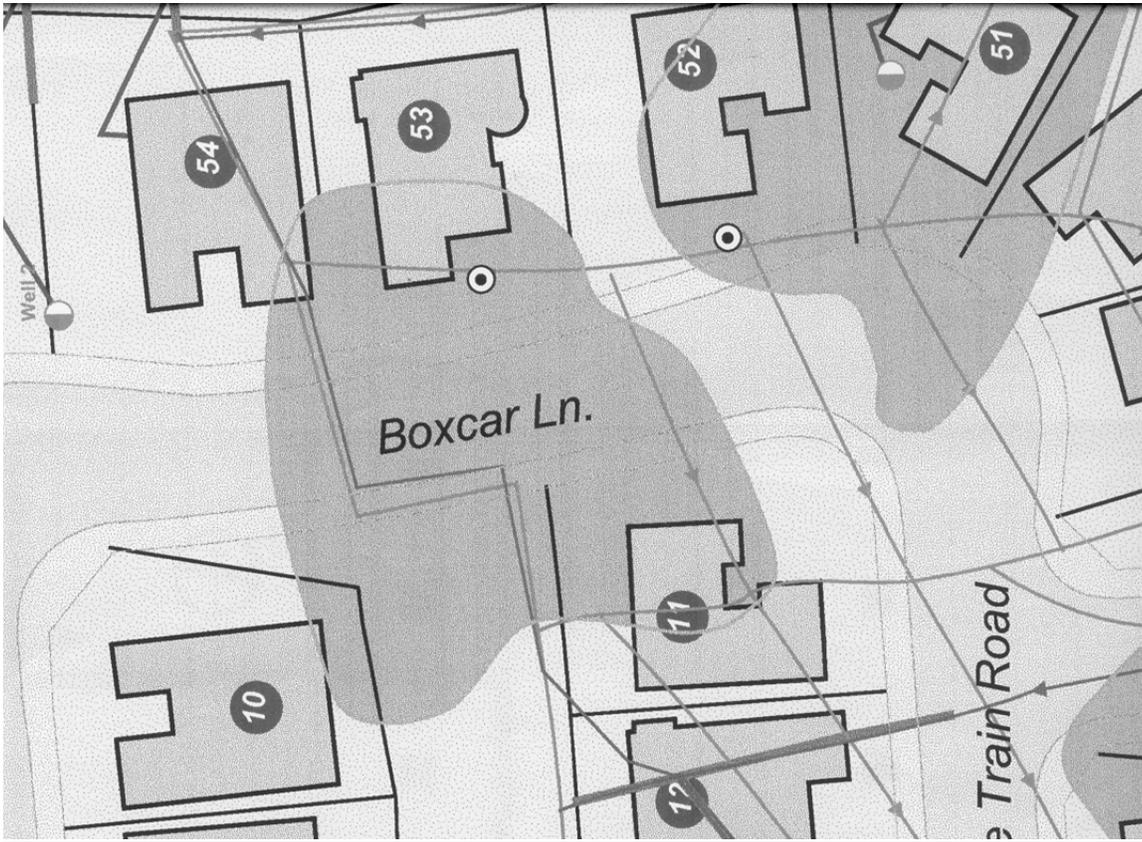


Figure No. 3 - Sample portion of a Composite Plan

BELOW-GRADE VENTING SYSTEM ELEMENTS

- A registered Professional Engineer experienced in combustible soil-gas mitigation shall supervise the installation of all below-grade venting system elements, including **Bottoms Mitigation** elements.
- Below-grade venting system elements may include, but shall not be limited to, such things as: trenching, piping, soil-gas collectors, and permeable media (e.g., sand and gravel).
- Below-grade venting systems may be either active or passive in design. Note that active mitigation systems may trigger additional environmental review and permits.
- The technologies, materials and methods used in the installation of below-grade venting system elements shall reflect the most current industry standards of care and professional practice.
- All technologies materials and methods used in the installation of below-grade venting system elements are subject to the review and approval of the City Fire Department.

SUB-SLAB SOIL-GAS COLLECTORS

- A registered Professional Engineer with experience in combustible soil-gas mitigation shall design and supervise the installation of all soil-gas collectors.
- Soil-gas collectors shall be factory slotted/perforated, HDPE, ABS, or PVC plastic.
- Soil-gas collectors may be constructed by one of the two methods described below:

- Round pipe soil-gas collectors shall be a minimum of three (3) inch diameter and centrally-located in a 12-in by 12-in trench (herein referred to as a “vent trench”) filled with clean 3/8-in gravel. The gravel must be protected with a Geotex-like fabric on all four sides of the trench. Over the top of the trench, and covering the entire footprint of the slab, a minimum of one (1) inch of clean, coarse-grade construction sand must be in full communication with the 3/8-in gravel vent trenches, and placed prior to an impervious membrane and concrete being installed.
- Flat pipe soil-gas collectors, 12-in wide with a minimum width of one (1) inch shall be centrally-located in a four (4) inch layer of clean, coarse-grade construction sand. The four (4) inch layer of sand must cover the entire footprint of the slab, and be placed prior to an impervious membrane and concrete being installed.
- Soil-gas collectors shall be centrally-located inside each discrete footed area to the best possible application, but subordinate to other structural or utility elements of the individual structure.
- Soil-gas collectors must be located inside each discrete footed area such that all areas under each section of slab are serviced by at least one sub-slab soil-gas collector.
- Soil-gas collectors shall not be spaced any greater than 50-ft center-to-center AND located no further than 25-ft from perimeter footings.

VENT RISERS

- A registered Professional Engineer with experience in combustible soil-gas mitigation shall supervise the design and installation of all vent risers.
- Each vent riser shall be fitted with a one 1-inch gas sampling port (and plug) accessible from the structure’s exterior - preferably in a common area and not a secured area, e.g., a backyard.
- All gas sampling ports shall be fitted with a permanent 3”X3½” identification placard (sign) to read: **“CAUTION: METHANE GAS TEST PORT.”**
- A minimum of two (2) vent risers (per structure soil-gas mitigation system) is required for each sub-slab soil-gas collector and vent system. Additional risers are required for larger structures per Table No. 1, shown below.

TABLE No. 1

Building Footprint	No. of Vent Risers
Less than or equal to 3,000 square feet	3
3,001 to 10,000 square feet	4
10,001 to 20,000 square feet	5
Greater than 20,000 square feet: additional risers	1 per 10,000-sqft

- Each vent riser shall be a minimum of three (3) inches in diameter.
- Vent risers shall be equally distributed (as best practical) across the footprint of the foundation and not clustered in one area.

- On tall buildings (i.e., greater than 30-ft in height) vent risers may be manifolded into common vent risers per the Uniform Mechanical Code for plumbing systems and based on equivalent cross-sectional area, however, no less than two vent risers shall terminate to the atmosphere.
- Vent risers shall be black iron, ABS or Sch-80 PVC plastic pipe. *NOTE: PLASTIC VENT RISERS MUST BE PROTECTED WITH NAIL-PLATES WHERE PIPING PENETRATES DIMENSIONAL TIMBER PER U.B.C. AND I.C.C. REQUIREMENTS.*
- All piping connections and joints of vent riser assemblies shall be permanently gas-tight.
- All vent risers shall be marked with permanent labels reading:

**“CAUTION: METHANE GAS IN PIPE,
IF DAMAGED IMMEDIATELY NOTIFY CITY FIRE DEPT.
NO SMOKING OR SPARKS WITHIN 20 FEET.”**

Said marking shall be located at five (5) foot intervals along the entire length of the riser assembly, including pipe runs within wall cavities and enclosed spaces, and at least once above the vent riser’s roof system point of penetration and/or termination to the atmosphere.

- All vent riser terminations shall have a minimum separation of ten (10) feet horizontally and four (4) feet vertically from any window or other building opening, including openings in adjacent structures.
- All vent riser terminations shall have a minimum separation of twenty (20) feet horizontally and eight (8) feet vertically from any air intake that services any building’s ventilation system.
- All vent riser roof terminations shall have a minimum separation of four (4) feet from any property line and three (3) feet from the face of the structure it serves.
- All vent riser terminations shall be fitted with a screened-TEE or screened rain cap to prevent the entry of birds, rodents, trash, debris, balls, etc.

PERIMETER DRAIN SYSTEMS

- Buildings constructed with a perimeter drain (also known as a French Drain) system outside, or exterior to, the perimeter footings shall be vented with at least one vent riser (as specified above) for each 150 linear feet of perimeter drain, and vent risers shall be installed at high points of elevation along the drain. For buildings with a building footprint greater than 10,000-sq-ft, each vent riser from the perimeter drain system will be equivalent to one vent riser for the sub-slab vent system, thereby reducing the number of vent risers required in the sub-slab system, respectively. However, the number of sub-slab vent risers in the building cannot be reduced to less than three.
- Large, engineered retaining walls that service a building or Project area shall be constructed with French drains that also have vent risers installed at a rate of one per 150-lin.ft. of drain, and vent risers shall be installed at high points of elevation along the drain.

VAPOR IMPERMEABLE MEMBRANES

- A registered Professional Engineer with experience in combustible soil-gas mitigation shall design and supervise the installation of all impermeable membranes used in mitigation systems.

- The installation of all mitigation system membranes shall be in accordance with plans reviewed and approved by the City of Brea Fire Department.
- Mitigation system membranes shall be composed of standard materials that are recognized throughout the soil-gas mitigation industry as being appropriate for the application; such as: Liquid Boot, High Density Polyethylene (HDPE), or equivalent materials.
- Mitigation system membranes shall be installed in accordance with all manufacturer’s specifications.
- ***LIQUID BOOT*** Applications shall be a minimum of **80 MILLIMETERS** nominal dry film thickness and 2-in by 4-in coupons shall be taken: one for every 500-sq.ft. in residential construction, and one for every 1,000-sq.ft in commercial construction. Coupons shall field-measured, once on each of the four sides of the coupon, in order to ensure adequate thickness, and recorded on field reports. All four measurements must meet or exceed minimum thickness.
- ***HDPE*** Installation shall be a minimum of **60 MILLIMETERS** thick and all seams shall be welded and leak tested per ASTM D-6392.
- All mitigation system membrane installations must be **SMOKE TESTED** a minimum of **TWO (2) TIMES**.
 - **THE FIRST SMOKE TEST** must be conducted within twenty-four hours after installation of the membrane is complete.
 - **THE SECOND SMOKE TEST** must be conducted just prior to the pouring/placing of any concrete foundations or slabs that permanently cover the membrane.
- Smoke tests of mitigation system membranes shall be conducted in accordance with current industry standards and methodologies.
- A California-registered Professional Engineer with experience in combustible soil-gas mitigation shall personally supervise all smoke testing of all mitigation system membranes.
- The concrete slab, once place, shall have a permanent sign stamped into the slab in a conspicuous location with the words:

***“PROTECTIVE MEMBRANE UNDER SLAB
DO NOT PENETRATE
CONTACT CITY BUILDING DEPARTMENT”***

MITIGATION SYSTEM INSPECTION/CERTIFICATION RECORDS

GENERAL REQUIREMENTS

- The Methane Mitigation Engineer shall prepare inspection records for each phase of each soil-gas mitigation element installed on each project and at each structure. These will include, at minimum, three **Project Certification Records**:
 - One recording the installation of **Project-site mitigation elements**:
 - Deep methane collectors and vent piping
 - Deep oil collectors and conveyance piping
 - Deep water collectors and vent piping

- Utility dams
- Long-term soil-gas monitoring probes
- Well casing vent cones, laterals, and risers
- One recording the installation of each structure's horizontal mitigation elements:
 - Soil-gas collectors, trenches, vent piping and pipe transitions
 - Geotex cover/fabric materials
 - Porous media and backfill below the foundation
 - Membrane, membrane carrier fabric, membrane penetrations
 - Smoke tests (two tests)
 - Vent riser transitions
- One recording the installation of each structure's vertical mitigation elements:
 - Vent riser pipe, laterals, and terminations (e.g., rain caps and screened TEES)
 - Vent riser connections and joints
 - Sampling ports on vent risers
 - Long-term soil-gas monitoring probes
 - Labels, caution placards, warning markers, and signage
 - As-built drawings
- A registered Professional Engineer with experience in combustible soil-gas mitigation shall complete, “wet” sign, and stamp each Inspection Record.
- All completed, signed, and stamped Inspection Records (including attached exhibits, photos, as-built drawings, membrane coupons, etc.) shall be submitted to the City Fire Department for each Project and for each structure
- **NOTE** - The City Fire Department must have in its possession all three completed **Project Certification Records** for construction/installation efforts, including all test data, manufacturer certifications/warranties, approval letters, etc., and all **Composite Drawings** (see: COMPOSITE DRAWINGS) before any Certificates of Completion or Certificates of Occupancy will be issued for the Project.

Example **Project Certification Records** are attached, see: Appendix B.

UTILITY DAMS

Utility dams (also known as: Trench Saddles) are installed to mitigate potential horizontal migration of combustible soil-gas when porous bedding materials (e.g., sand, pea-gravel) are used in trenches with utility piping. **Utility Dams** shall be periodically installed throughout a Project area AND immediately outside of each structure's foundation at the point that utilities meet, or traverse under, the foundation. The following describes applications of **Utility Dams** in Project areas affected by combustible soil-gas.

GENERAL REQUIREMENTS

- Utility Dams shall be required for all utility trenches in which a porous bedding or backfill material (e.g., sand or gravel) is used in lieu of a native soil backfill
- Utility Dams are not necessary when stone-free, native soil is used as backfill in 100% of the trench space AND the soil is compacted to at least 90% of its maximum compaction.
- In utility trenches where porous bedding (backfill) materials are used, every occupied structure shall have a Utility Dam installed in every trench where said trench meets, or extends under, the building's foundation. Moreover, Utility Dams must be located so that the edge of each dam, which is nearest to the structural footing, shall not be more than two (2) feet from the footing.
- In the Project area, one Utility Dam is required for every 300 linear feet of below-grade utility trench (containing utility lines), including: electrical (both high and low voltage systems), gas, water, sewers, drains, etc., where said utility lines are bedded in porous non-native materials.
- The City Fire Department may require additional Utility Dams placed within the Project area as deemed necessary.
- Locations of all Utility Dams shall be clearly identified on both Civil Engineering plans and **Composite Drawings** for the Project area.

UTILITY DAM SPECIFICATIONS

- Utility Dams shall be composed of a mix of a mix of one (1) sack of Portland Cement per cubic yard of sand with 2%-by dry weight Bentonite clay added. This mix shall be adequately hydrated with water prior to placing it into the utility trench.
- Utility Dams shall be a minimum size of three (3) feet in length, extending across the full width of the trench, and filled to a minimum height of twelve (12) inches above the level of the porous bedding material, or to finished grade, whichever is less.
- All soil placed above a Utility Dam shall be clean native soil, free of stones greater than one (1) inch, and compacted to at least 90% of its maximum compaction.
- All dry pipes and/or conduits passing through Utility Dams shall be sealed and gas-tight so as to prevent the seepage and migration of soil-gas within the pipe/conduit. The only exception to this requirement is storm drains.
- Installation of Utility Dams shall be subject to inspection and approval of City inspectors.
- Refer to Figure No. 5 for typical Utility Dam details.

OIL AND GAS WELLS

GENERAL REQUIREMENTS

- All oil and gas well casings, both existing, idled, abandoned, and/or dry (exploratory) holes, which are inside the Project area or within 300 feet of the Project's boundaries shall comply with current California Division of Oil, Gas and Geothermic Resources (DOGGR) standards.
- All well operations that are inside the Project area or within 300 feet of the Project's boundaries shall be subject to the regulations set forth in the most current edition of Article 79 of the California Fire Code.

- All wells, both existing, idled, abandoned, and/or dry (exploratory) holes, which are inside the Project area or within 300 feet of the Project’s boundaries shall comply with all requirements as maybe specified by the most current City of Brea Fire Department standards. **REQUIRED OIL AND GAS WELL SURVEY**
- Prior to issuance of grading permits, a survey shall be conducted to locate and identify all well casings, both within the Project area and within 300 feet of the Project’s boundaries.
- The results of said well survey shall be provided to the City Fire Department prior to the issuance of any grading permit.

ABANDONED OIL WELLS

ABANDONMENT STANDARDS

- All well casings shall be abandoned in accordance with current DOGGR standards.
- All previously abandoned oil wells that do not comply with current DOGGR standards shall be re-abandoned and brought into compliance prior to the issuance of any City building permits.
- All abandoned well casings shall be properly capped, coned, and vented.
- The City Fire Department shall be provided with documentation that certifies that all abandoned well casings, both inside the Project area and within 300-feet of the Project’s boundaries, meet current DOGGR standards prior to City grading permits being issued.

PROXIMITY TO STRUCTURES

- Residential structures shall not be constructed over a well casing.
- Residential structures shall not be constructed within ten (10) feet of a well casing.
- High-occupancy commercial buildings less than 10,000-sq.ft. In footprint shall not be constructed over a well casing
- Low-occupancy commercial buildings less than 10,000-sq,ft in footprint and high-occupancy commercial buildings greater than 10,000-sq.ft. in footprint, will be considered on an individual basis with respect to building placement and well location.
- “Open Air” structures, e.g., those used for parking cars, may be located over a well casing.

VENTING REQUIREMENTS

- All abandoned well casings within the Project area or within 300 feet of the Project’s boundaries shall be properly capped and vented in accordance with the most current City of Brea Fire Department requirements and guidelines, and current industry standards.
- In as much as possible, abandoned well casings shall be vented to City pre-approved “Flag Pole” type vents, or similar structures, away from Project structures.
- Flag pole vents shall extend a minimum of ten (10) feet above-grade and shall be clearly and permanently marked/labeled with the words: ***“Caution methane gas in pipe. If damaged immediately notify City Fire Dept. – Dial 911. No smoking or sparks within 20-feet.”***

- The point of soil-gas emission of flag pole vents shall be located at the very top of the pole, which shall be provided with a screened rain guard.
- Flag pole vents shall be fitted with a one 1-inch sampling port, located between two (2) to four (4) feet above-grade, near the base of the pole. The sampling port must be labeled with a permanent sign with the words: “**CAUTION METHANE GAS TEST PORT.**”
- Flag pole vents shall not be located within ten (10) feet of any structure.
- The point of soil-gas emission of flag pole vents shall not be less than three (3) feet above the roof line of any structure within twenty-five (25) feet of the flag pole vent’s location.
- Figure No. 6 depicts a generic Flag Pole vent.

VENTING TO STRUCTURES

- Whenever abandoned well casings must be vented to a structure, such venting shall comply with the most current requirements of the City Fire Department.
- Abandoned well casings that are vented to structures shall not be vented in any way that penetrates the building’s “structural envelope”.
- Abandoned well casings that are vented to structures shall have the vent pipes securely attached to the outside of an exterior wall – as depicted in Figure No. 7.
- If necessary, for aesthetic purposes, the vent pipe may be located in an “exterior vent riser chase” (as depicted in Figure No. 8), which must be designed by a Professional Engineer registered and licensed in the State of California with experience in the field of combustible soil-gas mitigation.
- Whenever abandoned well casings must be vented to a structure, detailed plans of the proposed venting system shall be submitted to the City Fire Department, with justification, for review and approval prior to any building permits being issued.

OPERATING OIL WELLS & AUXILIARY OPERATIONS

FIRE CODE ISSUES

- All operating oil wells that are inside the Project area, or within 300-feet of the Project’s boundaries, shall be subject to the regulations set forth in the most current adopted edition of the California Fire Code.
- All storage tanks and auxiliary oil field operations (i.e., dewatering operations, gas plants, pumping stations etc.) that are inside the Project area, or within 300-feet of the Project’s boundaries, shall, as applicable, be subject to the regulations set forth in the most current adopted edition of the California Fire Code.
- The City Fire Department, at its discretion, may require additional hazard mitigation measures to be designed and installed as necessary to enhance public safety.

VAULTING OF OPERATING OIL WELLS

- Operating oil and gas wells located within the Project area and which meet the following criteria:
 - Wells which are within 75-feet of a dedicated public street,

- Wells which are within 100-feet of any building, or
- Wells which are within 300-feet of any building used as a public assembly, institution or school,

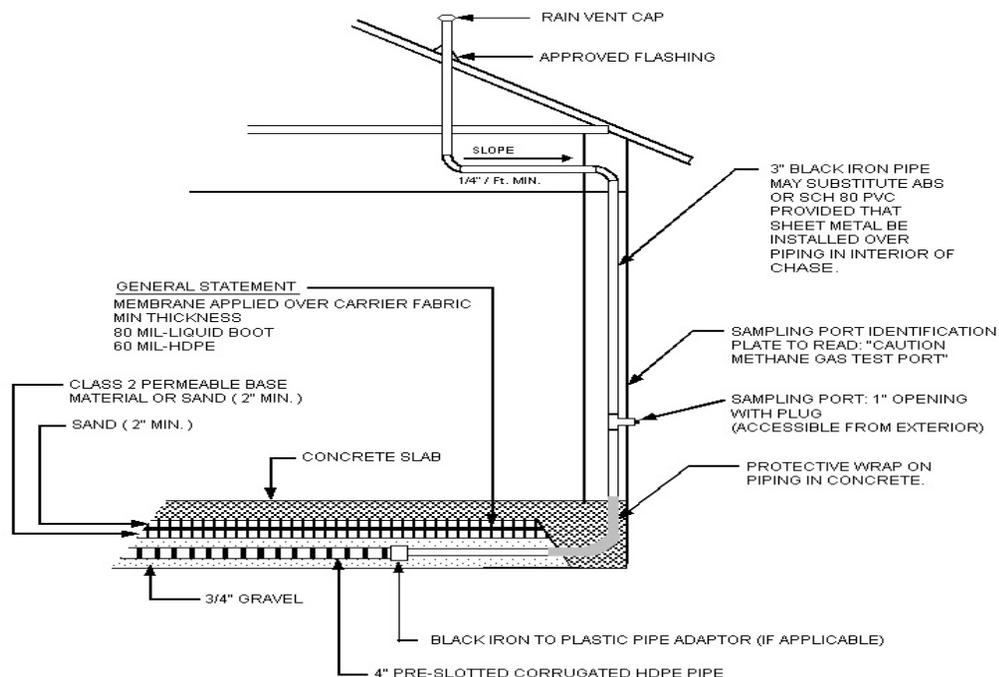
shall be vaulted as specified by the City Fire Department.

- All such vaults shall be constructed according to plans that have been approved by the City’s Fire Department and other applicable building officials.
- All such well vaults shall be constructed to include any mitigation measure, as may be deemed necessary to enhance Public Safety, as specified by the City’s Fire Department and/or applicable City building official.
- All such well vaults shall conform to the screening and aesthetic requirements specified by Brea’s City Planner.

ACCESS AND SECURITY

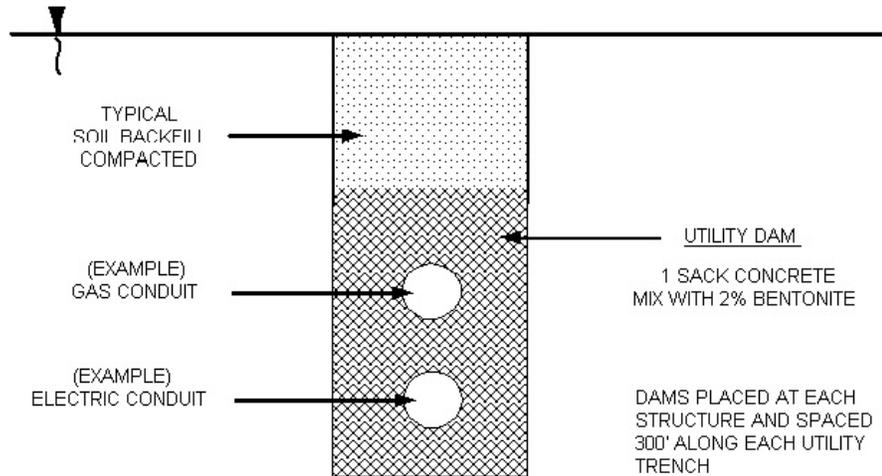
- All operating oil and gas wells and auxiliary oil field operations located inside the Project area or within 300-feet of the Project’s boundaries shall be fully accessible to the City Fire Department’s emergency vehicles.
- The City Fire Department, at its discretion, may require “all weather” fire access roads, which are 25-feet in width and capable of supporting a gross vehicle weight of 80,000-pounds, to any well or oil operation facility located inside the Project area or within 300-feet of the Project’s boundaries.
- All wells and oil operation facilities located inside the Project area or within 300-feet of the Project’s boundaries shall meet the most current City requirements for on-site security so as to provide for the safety of the general public.

FIGURE No. 4 - SAMPLE SOIL-GAS MITIGATION SYSTEM IN A SINGLE-STORY RESIDENTIAL APPLICATION



UTILITY DAM CROSS SECTION

NOTE: WHERE SAND OR GRAVEL IS USED AS A BEDDING MATERIAL IN UTILITY TRENCHES, UTILITY DAMS WILL BE INSTALLED AS PER DIAGRAM BELOW. IF COMPACTED SOIL IS USED AS BACKFILL, DAMS DO NOT NEED TO BE INSTALLED.



LONGITUDINAL SECTION

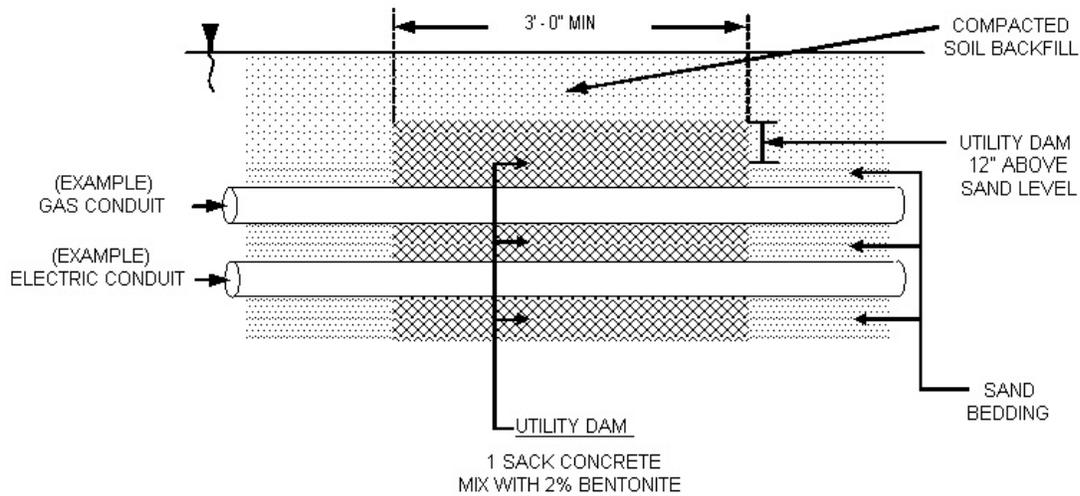


FIGURE No. 5 - SAMPLE UTILITY DAM ILLUSTRATIONS

DETAIL OF FLAG POLE VENT

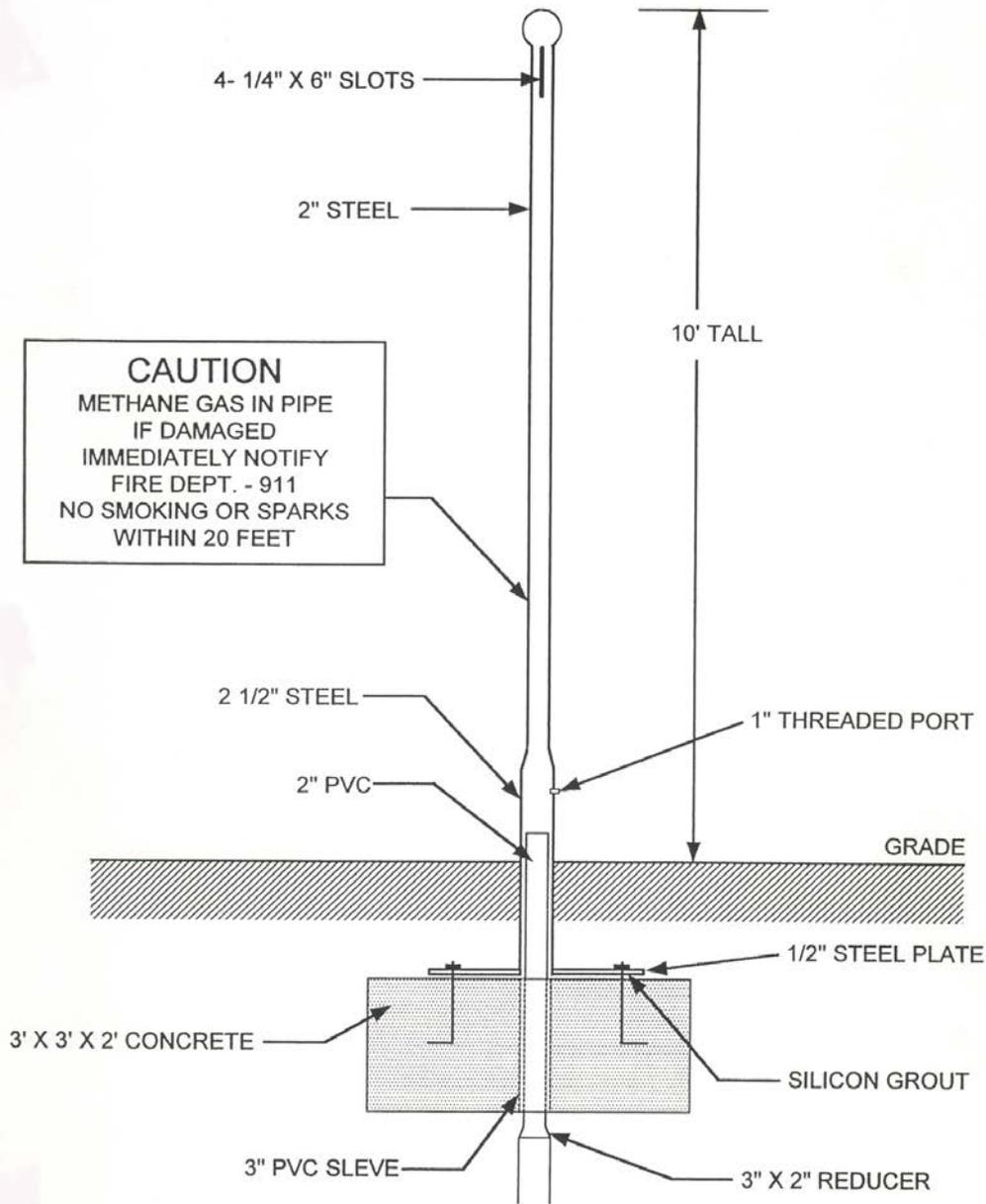
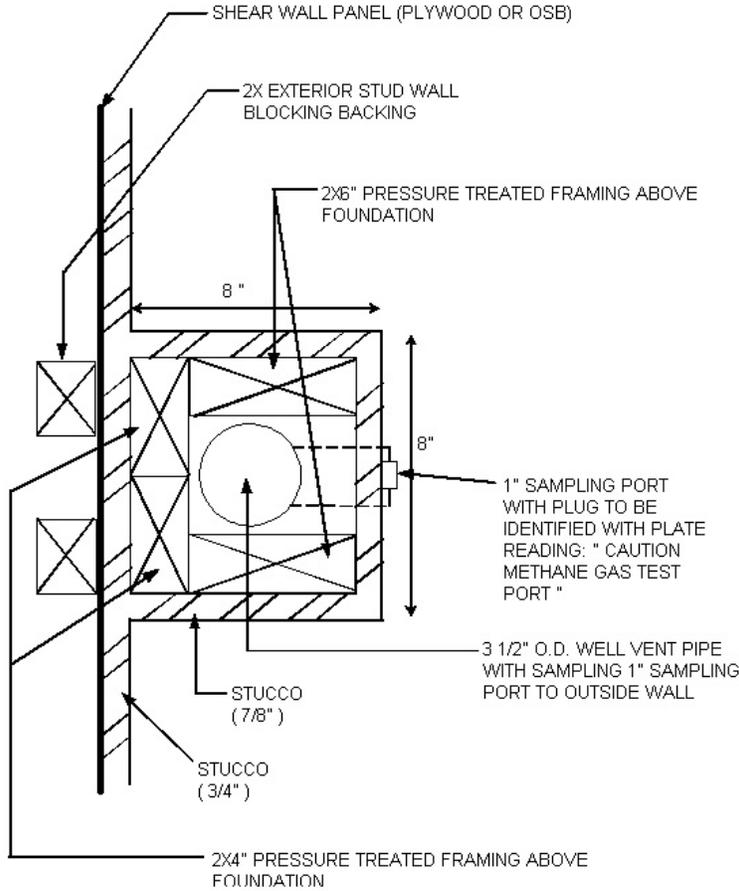


FIGURE No. 6 - SAMPLE FLAG POLE VENT

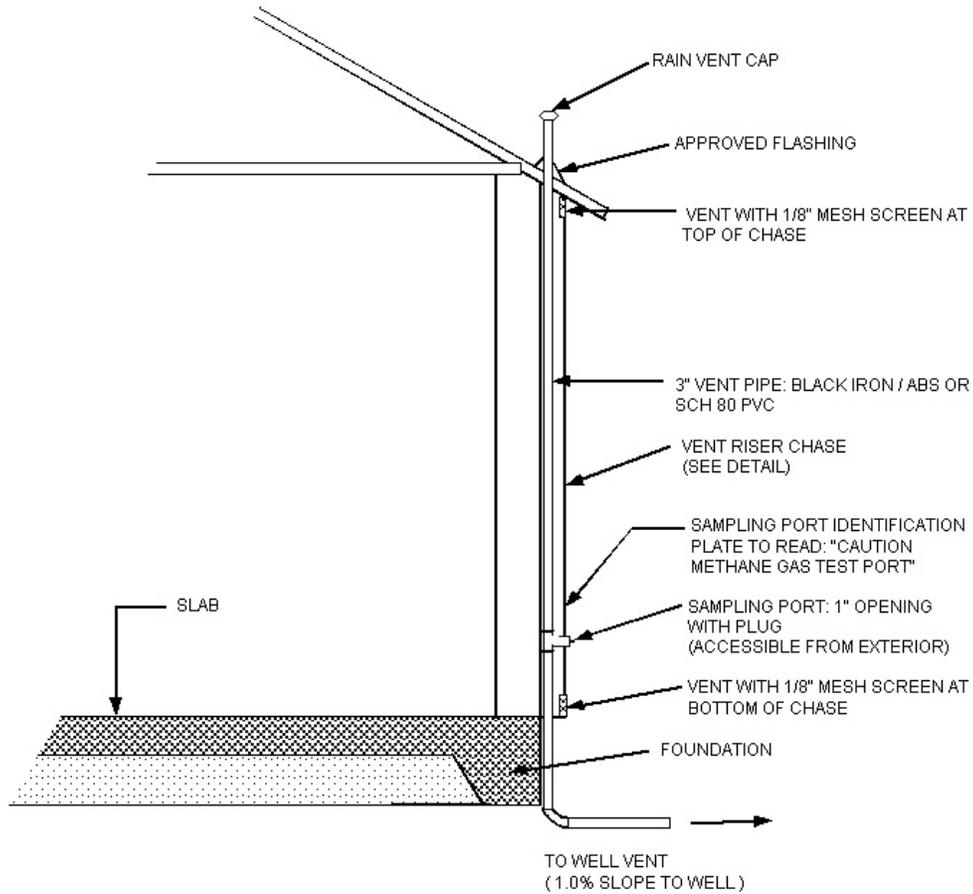
SAMPLE
WELL VENT RISER CHASE PLAN VIEW (TYPICAL)



NOTE: AT LEAST TWO AIR VENTS SHALL BE PROVIDED AS PART OF THE CHASE CONSTRUCTION (ONE AT THE TOP AND ONE AT THE BOTTOM OF THE CHASE) THESE SHALL BE A MINIMUM OF 3 INCHES IN DIAMETER AND COVERED WITH 1/8 INCH MESH METAL SCREENING MATERIAL.

FIGURE No. 7 - SAMPLE EXTERIOR VENT RISER CHASE

SAMPLE
EXTERIOR WALL VENT RISER



1) ROOF VENT EXHAUST PORT SHALL BE MIN. 10' AWAY AND 3' ABOVE ANY AIR INTAKE INTO STRUCTURE, MIN. 4' FROM ANY PROPERTY LINE.

2) VENT RISER SHALL BE MARKED WITH " METHANE GAS " AT ITS ROOF TERMINATION AND AT 5' INTERVALS ALONG ITS LENGTH WITHIN WALLS AND OTHER ENCLOSED AREAS PER OCFA GUIDELINES.

3) VENT RISER SHALL BE ENCLOSED IN AN APPROVED RISER CHASE EXTERIOR TO THE BUILDING ENVELOPE.

FIGURE No. 8 - SAMPLE EXTERIOR VENT RISER SYSTEM

PART - III

COMBUSTIBLE SOIL-GAS MONITORING

GENERAL REQUIREMENTS

As mentioned in the Purpose and Scope of the Brea Combustible Soil-Gas Ordinance, the City of Brea overlies two significant petroleum reservoirs, the Whittier Earthquake Fault bisects the reservoirs, and the fault's fractured bedrock provides vertical pathways for petroleum gases to seep upward from the (deep) reservoirs to the surface – there are known oil and gas seeps in the City. For these reasons, some developments in the City will be required to install combustible soil-gas mitigation systems and implement a soil-gas monitoring program. The monitoring program includes: installing permanent soil-gas monitoring probes, monitoring the probes (and other methane-related elements) on a periodic basis, maintaining the probes, and providing long-term funding to monitor/maintain methane-related elements in perpetuity; or until the City deems that it is no longer necessary to monitor/maintain these elements.

Due to the presence of significant concentrations of subsurface combustible soil-gas in certain areas of the City, long-term soil-gas monitoring shall be performed using permanent soil-gas sampling probes. In addition, monitoring other methane venting systems (e.g., vent risers) may be warranted. Long-term monitoring will be used to observe and keep an eye on, the concentration of subsurface combustible soil-gases in the Project area. It is deemed to be in the best interests of the City and for public safety to do so. The number of probes installed and the frequency at which they are sampled, is less than the criteria established for an initial soil-gas investigation. However, monitoring will occur no less than annually, probably quarterly, and if situations warrant, more frequent (than quarterly) monitoring may be necessary.

All new developments within the City of Brea Fire Department's jurisdiction that are included in areas known or suspected to be impacted by combustible soil-gas, and have **Full Mitigation** combustible soil-gas mitigation systems installed, and shall be subject to the following:

- All combustible soil-gas mitigation systems shall be designed, installed, and monitored in conformance with the most current version of the City of Brea's Combustible Soil-Gas Ordinance and mitigation requirements.
- A **Soil-Gas Monitoring Plan** shall be developed and implemented, and a **Soil-Gas Monitoring Report** shall be produced and submitted to the City, per the criteria so stated below, for routine and periodic assessment of combustible soil-gases where appropriate.
- Under special circumstances, the City's Fire Chief may require more or less stringent and/or more or less frequent, monitoring measures as deemed appropriate for protecting Public Safety.
- At its discretion, the City may request a third-party to review combustible soil-gas monitoring data/results submitted to the City.
- All Combustible soil-gas monitoring efforts shall be subject to inspection by City inspectors, moreover, monitoring methods shall be subject to the review and approval of City inspectors.
- At its discretion, the City may use qualified third-party inspectors to evaluate and assess the efficacy of monitoring and/or testing activities (by others) for combustible soil-gas. Moreover,

the City may require modifications to the means and methods of monitoring and/or testing for combustible soil-gas by others.

SOIL-GAS MONITORING PLAN

A **Soil-Gas Monitoring Plan** shall be applicable in areas where combustible soil-gases warrant full to substantial building mitigation measures, pursuant to the criteria so stated in **PART II – COMBUSTIBLE SOIL-GAS MITIGATION** of this Ordinance, and where known or suspected combustible soil-gas anomalies and/or seepage zones are present. The City shall be provided with a plan for monitoring combustible soil-gases, including:

- A **Soil-Gas Monitoring Plan** shall be developed, submitted and approved by the City prior to the City issuing certificates of completion/occupancy for any new development/construction in the City that is located in an area impacted or suspected of being impacted by combustible soil-gases.
- A combustible **Soil-Gas Monitoring Plan** shall be developed and submitted for review and approval to the City Fire Department. Said **Soil-Gas Monitoring Plan** shall be “wet” signed and stamped by a Professional Engineer registered and licensed in the State of California with at least five (5) years of experience specifically related to the field of combustible soil-gas mitigation. Said **Soil-Gas Monitoring Plan** shall provide justification for monitoring/testing means and methods, including but not limited to: soil-gas probe location, construction, frequency of sampling, data reporting, actions when elevated concentrations of soil-gas are detected, engineering controls to mitigate elevated soil-gas concentrations; and/or justification why monitoring may not be warranted.
- **Soil-Gas Monitoring Plans** shall incorporate all relevant criteria contained in this Ordinance.
- All technologies, materials and methods described in the plan shall reflect the most current industry standards of care and professional practice.

PERMANENT SOIL-GAS MONITORING PROBES

Soil-Gas Monitoring Plans shall include provisions for permanent soil-gas monitoring probes. Permanent soil-gas monitoring probes shall be located and constructed per the following criteria:

- Permanent combustible soil-gas monitoring probes shall be designed by a Professional Engineer registered and licensed in the State of California with at least five (5) years of experience specifically related to the field of combustible soil-gas mitigation. Designs shall be “wet” signed and stamped by the Professional Engineer, and submitted for review and approval to the City Fire Department.
- Permanent soil-gas monitoring probes shall be located in all areas with known or suspected combustible soil-gas anomalies or seepage zones, and within 300-ft of such areas.
- Permanent soil-gas monitoring probes shall be installed at a frequency of no less than one probe for every 50,000-sq.ft. of Project area.
- An example of a pre-approved Permanent Soil-Gas Monitoring Probe is shown in Figure No. 9
- Permanent soil-gas probes shall be triple-completion with porous sample tips placed at 5-ft, 10-ft and 20-ft below final grade elevations.

- Within 48-hours of constructing permanent soil-gas probes, at least two volumes of the sand-pack shall be removed/purged.
- Within 90-days of completing construction of the permanent soil-gas probes, the probe design engineer of record shall submit to the City a “wet” signed, stamped report that includes a map showing the location of all probes, boring logs, and probe as-built construction details.

FREQUENCY OF SOIL-GAS MONITORING

In areas where elevated concentrations of combustible soil-gas are known, identified, or suspected, regular and periodic soil-gas monitoring shall be required - with a frequency no less than annually. In areas with significant concentrations of combustible soil-gas (e.g., a soil-gas anomaly or seepage zone) the frequency shall be quarterly, and in extreme circumstances it may be more frequent.

MEANS AND METHODS OF SOIL-GAS MONITORING

The **Soil-Gas Monitoring Plan** shall also include all relevant information necessary to describe and implement a soil-gas monitoring program, including but not limited to:

- Standard operating procedures
- Soil-gas sampling and analysis protocols, methods, materials, and equipment
- Data recording, management, and reporting
- Field quality controls and data quality assurances

MONITORING COMBUSTIBLE SOIL-GASES

GENERAL REQUIREMENTS

In general, monitoring for combustible soil-gas will consist of field sampling and analysis, or laboratory analysis, of soil-gas samples extracted from soil-gas probes and vent risers. Samples can be extracted into appropriate field instruments that are capable of detecting small concentrations of relevant soil-gas chemicals, or collected into appropriate sample containers for laboratory submittal and analysis. In addition to monitoring the characteristics (i.e., chemical make-up) of soil-gas, sub-surface gas pressures shall be monitored from all soil-gas probes.

SOIL-GAS PROBES

After monitoring soil-gas pressure and prior to collecting a soil-gas sample for analysis, at least one “air volume” of the probe’s sand-pack shall be removed and purged.

SOIL-GAS MONITORING

All soil-gas monitoring must include the following:

- Sampling should be performed during periods of falling (not rising) barometric pressure.
- Prior to sampling soil-gas probes for chemical characteristics, they shall be monitored for pressure. Pressure sensing equipment shall be capable of detecting pressure differentials as low as:
 - 0.1-in of water column, or 25-Pascals.

- Soil-gas shall be characterized with equipment capable of detecting total hydrocarbons as methane, hydrogen sulfide, carbon dioxide, and oxygen. Chemical detectors shall be capable of a precision of:
 - (+/-) 50-parts per million by volume (ppm/v) for hydrocarbons,
 - (+/-) 1-parts per million by volume (ppm/v) for hydrogen sulfide, and
 - (+/-) 0.1-percent by volume (%v) for carbon dioxide and oxygen.
- In lieu of using field equipment, soil-gas samples can be collected in clean air-tight containers and submitted to a California-certified analytical laboratory for analysis of: total hydrocarbons as methane, hydrogen sulfide, carbon dioxide and oxygen with similar precision as stated above.

SOIL-GAS DATA

All soil-gas monitoring must include the following:

- Data shall be submitted to the City in a tabular format that includes: date, time, and the name of the technician collecting the data, chemical content of the soil-gas, soil-gas pressure, pre- and post-sampling barometric pressure, sample method, detector used, calibration certification verifying equipment operation and precision, etc.
- Soil-gas data shall be certified with a “wet” signature and stamp by a Professional Engineer licensed to practice in California and who is experienced in combustible soil-gas mitigation.

MONITORING OTHER SOIL-GAS SYSTEM ELEMENTS – Not Probes

At the same frequency and at the same time that soil-gas probes are sampled/monitored for concentrations of combustible soil-gas, other soil-gas mitigation elements should also be monitored, including:

- Vent risers from sub-slab soil-gas collectors
- Vent risers from below-grade bottoms-mitigation elements, e.g., methane collectors, oil drains, water drains, French drains, perimeter drains, oil well vaults, etc.
- Hardscape vents
- Well casing vents

These other system elements should be equipped with a monitoring port that is at least 5-ft below the top of the vent’s point of termination; and preferably 2-ft to 4-ft above ground elevation. Measuring and/or collecting soil-gas pressure is not warranted in vent risers, and therefore it is not necessary. Similarly, purging a “probe volume” is not necessary in vent risers. Sampling and analyzing the characteristics of soil-gas present within each vent riser shall follow the criteria for soil-gas probes.

SOIL-GAS MONITORING REPORT

The City shall be provided with timely submittals of all combustible soil-gas monitoring data, including:

- A clear and concise report containing all soil-gas monitoring data shall be submitted to the City Fire Department for review within 30-days of monitoring soil-gas concentrations.
- The City Fire Department may, at any point in time, require additional monitoring of soil-gas as may be necessary in order to ensure that all combustible soil-gas mitigation system elements comply with City requirements/guidelines, and that Public Safety is maintained.
- All combustible soil-gas monitoring reports shall be “wet” signed and stamped by a Professional Engineer registered and licensed in the State of California with at least five (5) years experience specifically related to the field of combustible soil-gas mitigation. Said engineer shall have at the time that data/results are submittal, comprehensive general liability insurance and professional errors and omissions insurance suitable to the City.
- If the Professional Engineer uses a technician to collect/analyze soil-gas samples, the technician shall also “wet” sign the monitoring report.
- All soil-gas monitoring data shall be depicted both in tabular form and graphically, and graphs shall be represented historically (on a time-line) with all previous monitoring data, for each monitoring location, represented on the graph. Moreover, all data points that are at least **25%** greater than the previous historical data point, and/or trends of data points that are consistently increasing in concentration of combustible soil-gas, shall be duly noted on the graph, on a corresponding project map, and in the text of the report.
- All report shall include a standard operating procedure (SOP) describing the means and methods of collecting the soil-gas sample, characterizing the soil-gas sample, equipment used to collect and analyze the soil gas sample, calibration and leak-test procedures used to ensure that the soil-gas sample and the data thereof is representative and accurate, and QA/QC protocols.
- One copy of the monitoring report shall be submitted as a bound hard copy, and a second copy of the report submitted as an electronic PDF-formatted copy on a CD. The electronic copy must include the “wet” signed and stamped signature pages referenced herein.

Based on findings of the monitoring effort, the following notifications are relevant and applicable:

- The City Fire Department must receive notice within forty-eight (48) hours if significant concentrations of combustible soil-gas are detected in any of the following circumstances:
 - 25% LEL or higher in any occupied space
 - 50% LEL or higher immediately under any unprotected building
 - 100% LEL or higher immediately under any protected/mitigated building
 - 100% LEL or higher in any sub-slab vent riser
 - 100% LEL or higher in any storm drain or open utility vault
 - 15%v or higher in any closed utility vault
 - 25%v or higher in any dedicated, **Bottoms Mitigation** methane vent riser.
- The City Fire Department must receive notice within forty-eight (48) hours if significant concentrations of hydrogen sulfide soil-gas are detected in any of the following circumstances:

- 1-ppmv or higher in any occupied space
 - 5-ppmv or higher immediately under any unprotected building
 - 10-ppmv or higher immediately under any protected/mitigated building
 - 10-ppmv or higher in any sub-slab vent riser
 - 10-ppmv or higher in any storm drain or open utility vault
 - 25-ppmv or higher in any closed utility vault
 - 25-ppmv or higher in any dedicated, **Bottoms Mitigation** methane vent riser.
- The City Fire Department must receive at least forty-eight (48) hours notice if any of the following circumstances are detected/observed during a monitoring effort:
 - Breached membrane barrier materials
 - Breached, damaged, or blocked methane mitigation systems
 - Dysfunctional soil-gas mitigation and/or treatment systems

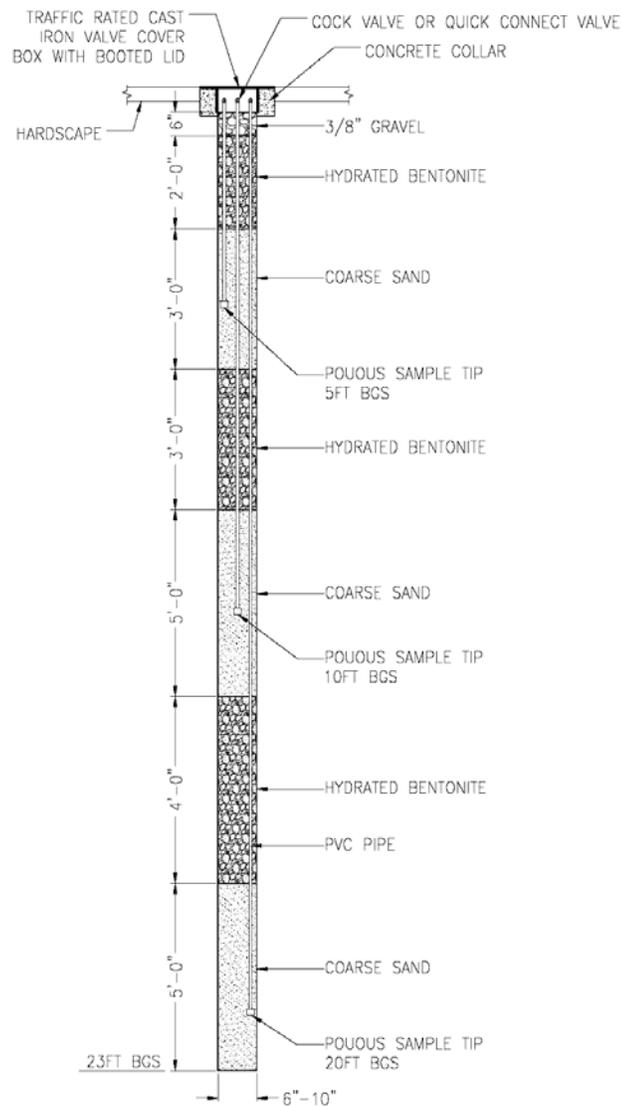


FIGURE No. 9 – SAMPLE Permanent Soil-Gas Monitoring Probe

PART - IV

MAINTENANCE OF SOIL-GAS MITIGATION SYSTEMS

GENERAL REQUIREMENTS

All developments within the City of Brea Fire Department's jurisdiction that are included in areas known or suspected to be impacted by combustible soil-gas AND have mitigation systems installed, will require at least the minimum criteria for maintenance, and shall be subject to the following:

- All combustible soil-gas mitigation systems shall be designed, installed, monitored and maintained in conformance with the most current version of the City of Brea's Combustible Soil-Gas Ordinance and mitigation requirements.
- At its discretion, the City may use qualified third-party inspectors to oversee the monitoring and/or maintenance of combustible soil-gas mitigation systems.
- The City Fire Department must receive at least forty-eight (48) hours notice prior to any of the following maintenance activities:
 - Breaching membrane barrier materials
 - Breaching or constructing below-grade, **Bottoms Mitigation** systems
 - Installing additional soil-gas mitigation and/or treatment systems
 - Converting passive vent systems into active vent systems

 - Pursuant to all of the bulleted list of items above, if the City Fire Department decides it is in the best interests of Public Safety to stop an aforementioned activity, that activity shall stop until adequate safety measures are put in place to the satisfaction of the City Fire Department.
- Maintenance shall include all routine and non-routine tasks associated with maintaining elements for combustible soil-gas mitigation and monitoring, including but not limited to:
 - Repairing/replacing vent risers
 - Repairing/replacing components of active system elements
 - Flushing sediments from drainage systems that also vent soil-gases
 - Repairing/replacing soil-gas monitoring probes
- The City Fire Department may, at any point in time, require additional maintenance, improvements and/or modifications to mitigation and/or monitoring elements, including submittals of plans, detailed drawings, specifications, data, reports, inspections, testing, etc., as may be necessary in order to ensure that all combustible soil-gas elements comply with current City requirements and guidelines.
- Maintenance of all combustible soil-gas system elements shall be supervised by a Professional Engineer registered and licensed in the State of California with at least five (5) years of experience specifically related to the field of combustible soil-gas mitigation. Said engineer shall have, at the time of supervising maintenance of soil-gas mitigation system elements, comprehensive general liability insurance and professional errors and omissions insurance suitable to the City.

- An annual **Maintenance Report** of all maintenance activities associated with combustible soil-gas mitigation and monitoring elements shall be submitted to the City Fire Department.

MAINTENANCE OF COMBUSTIBLE SOIL-GAS SYSTEM ELEMENTS

GENERAL REQUIREMENTS

In general and if constructed properly, the maintenance of passive combustible soil-gas mitigation and monitoring system elements, that are installed in conjunction with new construction, should be minor. Moreover, some elements, e.g., sub-slab membranes, typically do not require maintenance. In general, the following shall apply:

BELOW-GRADE PASSIVE ELEMENTS

The following below-grade passive elements typically do not require a maintenance activity as long as they are not disturbed and/or breached in any way. These include:

- Below-Grade Mitigation Systems
- Vapor Impermeable Barriers
- Utility Dams
- Sub-Slab Soil-Gas Collectors
- Perimeter and French Drains

One notable exception shall be French Drains and/or Perimeter Drains near buildings. These drains serve a dual purpose: one, they are used to convey excess water to a sump or storm drain; and two, the high (elevation) end of the drain system shall be equipped with a vent riser to convey combustible soil-gas safely away from site improvements/structures. The vent riser shall be maintained per the criteria mentioned below. The drain system should be equipped with appropriately placed clean-outs such that the drain network can be periodically flushed to remove soil particles that may have settled within the network of drainage piping; which may occlude flow.

ABOVE-GRADE VENT RISERS

The following above-grade vents risers typically require minimal maintenance.

- Vent Risers from Sub-slab and other Below-Grade Soil-Gas Collectors
- Hardscape Vents
- Well Casing Vents
- Oil Well Vents

Maintenance of vent risers shall include, but not be limited to, all of the following:

- Maintain vent piping/riser flow from obstructions
- Maintain rain caps
- Maintain bug/bird screens
- Maintain/replace methane notification labels
- Maintain monitoring ports
- Maintain access and clearance and function
- Remove vegetation where necessary to maintain function

SOIL-GAS MONITORING PROBES

Maintenance of temporary soil-gas monitoring probes is typically not necessary; because they are temporary. However, permanent soil-gas monitoring probes shall be maintained to ensure their function in perpetuity. If a monitoring probe cannot be maintained and/or its function restored, it shall be reported to the City Fire Department within 30-days of determining that it is no longer functional. The City Fire Department may require that the monitoring probe be replaced with a new probe, and the new probe may, or may not, be placed in the same location as the old probe. Maintenance of soil-gas monitoring probes should be performed in conjunction with monitoring efforts. Maintenance of permanent monitoring probes shall include, but not be limited to, all of the following:

- Maintain the protective cover (i.e., valve-cover box) over the top of the probe
- Maintain drainage around the top of the probes
- Maintain and eliminate insects within the protective cover
- Maintain/replace probe identification labels
- Maintain monitoring ports, cock valves, fitting, and/or quick-connects
- Annually sound the probe to verify depth and ensure that it is not plugged or watered-in
- Maintain access and clearance to the probe and remove vegetation where necessary
- Maintain function

ANNUAL MAINTENANCE REPORT

As mentioned earlier in this section, an **Annual Maintenance Report** of maintenance efforts shall be submitted to the City Fire Department that describes all activities, actions, observations, and findings associated with the maintenance activities described herein. Note – the Maintenance Report may be submitted in conjunction with a **Monitoring Report** if so noted in the cover letter submitting the aforementioned reports. The City shall be provided with a timely submittal (e.g., within 90-days of year end) of each combustible soil-gas Maintenance Report, including

- Each Maintenance Report shall be “wet” signed and stamped by a Professional Engineer registered and licensed in the State of California with at least five (5) years of experience specifically related to the field of combustible soil-gas mitigation.
- Each Maintenance Report shall provide justification for all maintenance activities, describe in detail the means and methods of those activities, recommend follow-up actions where warranted, identify completed actions, and/or justify why maintenance may not be warranted.
- One copy of the Maintenance Report shall be submitted as a bound hard copy, and a second copy of the report submitted as an electronic PDF-formatted copy on a CD. The electronic copy must include the “wet” signed and stamped signature pages referenced herein.

PART - V

LONG-TERM FUNDING OF COMBUSTIBLE SOIL-GAS MITIGATION AND MONITORING SYSTEMS

GENERAL REQUIREMENTS

All new developments within the City of Brea Fire Department's jurisdiction that are included in areas known or suspected to be impacted by combustible soil-gas will require at least the minimum criteria for combustible soil-gas mitigation, and shall be subject to the following:

- All combustible soil-gas mitigation systems shall be designed , installed, monitored and maintained in conformance with the most current version of the City of Brea's Combustible Soil-Gas Guideline and mitigation requirements.
- Under special circumstances, the City's Fire Chief may require more, or less, stringent mitigation, monitoring and/or maintenance measures as deemed appropriate for protecting public safety.
- All combustible soil-gas mitigation systems shall be adequately funded, in perpetuity, to provide for the full cost of monitoring and maintenance of said systems.

ROLES AND RESPONSIBILITIES

BUILDER AND/OR DEVELOPER RESPONSIBILITIES

At a minimum, all Builders and/or Developers of new properties constructed in the City who are required to install combustible-soil gas mitigation systems, required to develop and implement a **Monitoring Plan** to test for and report on combustible soil-gases, and/or required to development and implement a **Maintenance Plan** for purposes of maintaining said mitigation systems, pursuant to criteria so stated in this Guideline, shall also be responsible for all of the following:

- Monitor, maintain, and report on all combustible soil-gas mitigation system elements constructed and/or installed on the property, in accordance with criteria in this Guideline, until which time control of said Project is relinquished to the Owner.
- Establish an account (e.g., escrow account) to be used for the sole purpose of funding the monitoring and/or maintenance all combustible soil-gas mitigation system elements constructed and installed on said Project; elements which shall comply with all City requirements and guidelines in effect at the time that the certificates of completion and/or certificates of occupancy are granted for said Projects.
- Provide sufficient monies into said account to fund at least 12 months of monitoring, maintenance, and reporting (in accordance with criteria in this Guideline) following the date that the Builder and/or Developer ceases to be on site, controls and/or releases interest in said Projects.
- Establish a means (e.g., CCRs) for future Owners to be made aware of their roles and responsibilities to monitor and maintain said combustible soil-gas mitigation elements,

and fund the monitoring, maintenance, and reporting of said systems; all in accordance with this Ordinance.

PROPERTY OWNER RESPONSIBILITIES

At a minimum, all Owners of new properties (i.e., the Project) constructed with combustible soil-gas mitigation systems, who are required to implement a routine and periodic **Monitoring Plan** to test for combustible soil-gases, provide a **Monitoring Report** on combustible soil-gas concentrations, and/or provide an annual **Maintenance Report** describing maintenance activities of said combustible soil-gas mitigation systems, pursuant to criteria so stated in this Ordinance, shall be subject to all of the following:

- Establish and maintain an account (e.g., escrow account) to be used for the sole purpose of funding the monitoring, maintenance, and reporting all combustible soil-gas mitigation system elements constructed and installed on the property; elements which shall comply with City and OCFA requirements/guidelines in effect at the time that the certificates of completion and/or certificates of occupancy are granted for said properties.
- Maintain and replenish funding of said account in perpetuity for the sole purpose of monitoring, maintenance, and reporting of combustible soil-gas mitigation elements for said properties; or until which time that the City deems it no longer necessary to do so.
- Establish a means (e.g., CCRs) for future Owners to be made aware of their roles and responsibilities to monitor, maintain, and report said combustible soil-gas mitigation elements, and fund the monitoring, maintenance, and reporting of said systems.

CITY OF BREA RESPONSIBILITIES

Pursuant to this Combustible Soil-Gas Guideline and in the interest of Public Safety, the City shall provide the following services:

- Provide timely review of documents, plans and specifications submitted for the City's review
- Provide timely comments to queries submitted for the City's consideration
- Provide timely approvals of documents, plans, and specifications submitted to the City; where applicable.
- Provide timely field inspections of the installation, construction, and repair of combustible soil-gas mitigation and monitoring elements; where applicable
- Enforce the criteria and requirements so stated in this Ordinance to maintain Public Safety.

CITY'S RIGHT TO CONDEMN AND/OR LIEN PROPERTY FOR FAILURE TO COMPLY

This Guideline has been adopted by reference as a part of City Ordinance 1211 (reference 2019 CFC with local amendments). As such, any person(s) who violates of the provisions contained within this Guideline is guilty of a misdemeanor, and/or administrative penalties as provided in CFC Section 109.4 as locally amended. Non-compliance with this Guideline includes but is not limited to the failure to:

- Install combustible soil-gas elements installed on said property in accordance with this Guideline,

- Properly maintain full function of combustible soil-gas elements installed on said property in accordance with this Guideline,
- Monitor combustible soil-gas elements installed on said property in accordance with this Guideline and/or a City-approved **Monitoring Plan** that was prepared in accordance with this Guideline,
- Provide timely, truthful and accurate reports on the concentration of combustible soil-gases on said property, and/or
- Provide timely, truthful and accurate reports on the condition and status of mitigation elements installed on said property; in accordance with this Guideline.

Upon determining that a property is not in compliance with this Guideline, the City may, at its discretion, implement the following:

- Retain a third-party to review and report on the status of combustible soil-gas mitigation elements of said property
- Retain a third-party to monitor combustible soil-gas mitigation elements of said property.
- Retain a third-party to provide maintenance and/or repairs to combustible soil-gas mitigation elements of said property
- Retain a third-party to implement corrective actions to restore function of non-functional combustible soil-gas mitigation elements of said property

All costs associated with implementing these measures are the responsibility of the property owner. The City will pursue legal remedies to obtain full restitution associated with pursuing compliance.

INTENTIONAL ENDANGERMENT

Professional service providers, developers, contractors, owners, and other persons involved with properties impacted with combustible soil-gas warranting mitigation systems as described herein, who knowingly and intentionally fail to comply with this Guideline and whose actions potentially endanger others, shall be subject to criminal prosecution pursuant to California Penal Code. Intentional endangerment may consist of, but is not limited to, any of the following:

- Failing to investigate and/or under-reporting combustible soil-gas concentrations of property within the City of Brea that may be impacted by combustible soil-gas.
- Damaging, destroying, or rendering non-functional combustible soil-gas mitigation elements without reporting, repairing and/or replacing said elements.
- Breaching combustible soil-gas mitigation systems and allowing combustible soil-gases to seep into occupied structures without controls.
- Failing to report excessive and/or elevated concentrations of combustible soil-gas inside occupied structures
- Falsifying combustible soil-gas concentrations in monitoring reports; specifically under-reporting soil-gas concentrations in order to hide elevated concentrations.

**CITY OF BREA
COMBUSTIBLE SOIL-GAS ORDINANCE**

APPENDIX B

***SAMPLE*
FIELD INSPECTION
PROJECT CERTIFICATION RECORDS:**

**Project-Site Mitigation Elements
(Structure) Horizontal Mitigation Elements
(Structure) Vertical Mitigation Elements**

Project Site Elements Deep Vents, Well Vents & Utility Dam - Inspection Record

<p><u>Contractor Information</u></p> <p>Builder: _____</p> <p>Site Superintendent: _____</p> <p>Vent System Contractor: _____</p> <p>Supervisor (name): _____</p> <p>Excavation Contractor: _____</p> <p>Supervisor (name): _____</p>	<p><u>Project Information</u></p> <p>Project Name: _____</p> <p>Project Area: _____</p> <p>Tract Number: _____</p> <p>Lot Number: _____</p> <p>Inspection Firm: _____</p>
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Deep Vent Systems Installation

AVG. DEPTH OF VENT TRENCH (____) FEET (PICTURE)

AVG. DEPTH OF GRAVEL BED (____) FEET (PICTURE)

VERTICAL RISERS AT HIGH ELEVATIONS, DRAINS AT LOW FILTER FABRIC PROPERLY INSTALLED (PICTURE)

CONFIGURATION DEEP VENT SYSTEM MATCHES PLANS (REFER TO LOCATIONS AND DIMENSIONS ON PLANS)

Authorization to Proceed with Backfill & Compaction

INSPECTOR NAME _____

(SIGNATURE): _____

OK	NOT OK	NOTE #	INSPECTION DATE	CORRECTION DATE

DATE

Well Abandonment & Vent Installation

WELLS ABANDONED TO DOGGR STANDARDS

EACH WELL NEEDS CERTIFICATE! WELL NO. _____

LEAK TESTS PERFORMED LEAKERS: YES / NO

VENT CONES INSTALLED PROPERLY (PICTURE)

VENT RISERS INSTALLED, TAGGED & LABELS

Authorization to Proceed with Backfill & Compaction

INSPECTOR NAME _____

(SIGNATURE): _____

OK	NOT OK	NOTE #	INSPECTION DATE	CORRECTION DATE

DATE

Utility Dam Installation

1-SACK CONCRETE MIX OR COMPACTED NATIVE SOIL

UTILITY DAM FILLED MIN. 12-IN ABOVE SAND BEDDING

WIDTH OF UTILITY DAM 5-FT (PICTURE)

UTILITY DAMS INSTALLED EVERY 300-FT OF TRENCH

UTILITY DAMS INSTALLED OUTSIDE BUILDING FOOTING

Final Approval: Vent System & Membrane Installation

INSPECTOR NAME _____

(SIGNATURE): _____

INSPECTOR NAME _____

(PRINT): _____

PROFESSIONAL ENGINEER: _____

OK	NOT OK	NOTE #	INSPECTION DATE	CORRECTION DATE

DATE

SEAL HERE

ATTACH NOTES, PHOTOGRAPHS, AND OTHER FIELD RECORDS TO THIS FORM PRIOR TO SUBMITTAL. CITY OF BREA

Vertical Elements Vent Risers & Monitoring Probe – Inspection Record

<u>Contractor Information</u> Builder: _____ Site Superintendent: _____ Vent System Contractor: _____ Supervisor (name): _____ Probe Install Contractor: _____ Supervisor (name): _____	<u>Project Information</u> Project Name: _____ Project Area: _____ Tract Number: _____ Lot Number: _____ Inspection Firm: _____
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Vent Riser Installation

VENT RISERS CLEAN AND UNOBSTRUCTED

VENT RISERS HAVE GAS-TIGHT COUPLES / CONNECTIONS

VENT RISER HORIZONTALS SLOPE BACK TO SOIL

CONFIGURATION & NO. OF VENT RISERS MATCH PLANS
(REFER TO LOCATIONS AND DETAILS ON PLANS)

VENT RISERS HAVE WARNING LABELS EVERY 5-FT

VENT RISERS HAVE REDUCER WITH 1-IN SAMPLING PORT

VENT RISER RAIN CAPS & SCREENED TEES INSTALLED

MEMBRANE NOTIFICATION PLACARD INSTALLED (PICTURE)

OK	NOT OK	NOTE #	INSPECTION DATE	CORRECTION DATE

Authorization to Cover Vent Risers

INSPECTOR NAME
(SIGNATURE): _____

INSPECTOR NAME
(PRINT): _____

DATE

Soil-Gas Monitoring Probe Installation

AUGERED BORE-HOLE TO PROPER DEPTH (MIN 23-FT)

TRIPLE-NESTED SOIL GAS PROBES: 5-FT 10-FT & 20-FT

PROBE TUBING: MIN ½-IN OPEN-ENDED, PERF. PVC PIPE

HYDRATED BENTONITE SEAL BETWEEN SAND-PACKS

PROBE CONSTRUCTION (BORING) LOGS COMPLETED

PROBE PLACEMENT & CONSTRUCTION MATCHES PLANS
(REFER TO LOCATIONS AND DETAILS ON PLANS)

TRAFFIC-RATED VALE-COVER BOX CEMENTED IN

6-IN DRAINAGE GRAVEL LAYER IN BASE OF VAVLE BOX

PROBES COMPLETED WITH VALVES & ID TAGS (PICTURE)

OK	NOT OK	NOTE #	INSPECTION DATE	CORRECTION DATE

Final Approval: Permanent Soil-Gas Probe Completion

INSPECTOR NAME
(SIGNATURE): _____

INSPECTOR NAME
(PRINT): _____

PROFESSIONAL ENGINEER: _____

DATE

SEAL HERE

ATTACH NOTES, PHOTOGRAPHS, AND OTHER FIELD RECORDS TO THIS FORM PRIOR TO SUBMITTAL. CITY OF BREA