NCDEQ Brownfields Program
Threshold Criteria For Methane Site Development
(December 2020)

Because of the nature of the hazard from flammable methane (CH_4) gas, for any redevelopment on a brownfields property where methane is a concern (generally methane greater than 1.25% by volume [%bv] or pressure generation greater than atmospheric for the purposes of this guidance) as determined through assessment following the *NC DEQ Program Methane Assessment Protocol (July 2020 – Rev. September 2020)* guidelines, the program will employ a tiered approach to redevelopment uses it will consider suitable for a brownfields agreement. The program's default assumption on methane sites is for recreational use only. Progressively more intensive exposures/uses will have threshold criteria to meet before the program would consider them for a brownfields agreement. Certain conditions, should they exist, will negate residential use altogether.

Be advised that the criteria outlined in this document do not waive any applicable requirements to obtain any necessary permits, licenses, or certifications for site development nor does it waive any requirement to comply with applicable law for such activities. Specifically, input from local health and fire departments shall be sought and their input incorporated into any planned site developments. Details in this document do not obviate the need to comply with these local requirements.

If the Brownfields Property was previously either a permitted solid waste facility or part of the NCDEQ Pre-Regulatory Landfill Program, no residential use shall be permitted. If portions or the entirety of the Brownfields Property were historically used as a mass waste dumping area, mitigation in the form of landfill venting **will be required** of defined waste areas in addition to the building footprint mitigation measures required herein.

All methane concentration and pressure data available on the Brownfields Property will be evaluated in making risk management determinations in accordance with this Threshold Criteria. Sample locations may be evaluated both spatially and temporally to account for variability in site conditions and determine suitable reuses on various portions of the property. Note that additional sampling may be required in accordance with the NC DEQ Brownfields Program Methane Assessment Protocol July 2020 – Rev. December 2020.

Recreational/Open Space Reuse - While recreational/open space is the default redevelopment land use for methane generating sites, there are still measures for methane protections that may be needed for any brownfields agreement that proposes recreational uses. These may involve but are not limited to: waste area venting, impervious surface and enclosed space restrictions, as well as electrical spark or flame safety.

The suitability of all of the uses below will be evaluated on a site by site basis as well as considerations such as the type of waste present, depth, age, etc. They will also **require, from assessment to conceptual design, mitigation and monitoring, the expertise of an environmental consultant(s) and professional engineer(s) in the State of North Carolina, with demonstrated experience in safely redeveloping such projects to the satisfaction of DEQ. Submitted plans to include redevelopment design mitigation implementation, operation and maintenance of mitigation/remediation measures, and periodic monitoring shall be signed and sealed by said professional engineer for the protection of public health.**

Industrial/Warehouse Reuse – Threshold criteria for suitability of this mode of redevelopment to be considered include:

1) Static pressure below 0.1 pounds per square inch (PSI) [2.77 inches of water] (CA DTSC, 2005) within 200 feet of the building footprint (frequency of pressure sample collection will be based on the site conceptual model and specific conditions present);
2) A minimum of a spray applied membrane and the appropriate sub-slab vapor intrusion mitigation measures as defined below; and
3) Ongoing alarm system monitoring/checks and field measurements as defined in the ongoing monitoring requirements section below.

Commercial Reuse (other than educational and child care) – Threshold criteria for the suitability of this mode of redevelopment to be considered include:

1) Static pressure below 0.07 PSI [2.0 inches of water] (LADBS, 2010) within 200 feet of the building footprint.
2) A minimum of a spray applied membrane and the appropriate sub-slab vapor intrusion mitigation measures as defined below.
3) Ongoing alarm system monitoring/checks and field measurements as defined in the ongoing monitoring requirements section below.

Note: Redevelopment using Podium construction where there is open air parking below all structures *may* obviate these thresholds and guidelines. Consult the program for further information.

Residential Reuse (including educational and commercial child care) – Threshold criteria for the suitability of this mode of redevelopment to be considered include:

1) No measurable static pressure differential greater than atmospheric pressure within 200 feet of the building footprint.
2) Methane levels in soil vapor are below 30%bv (600% LEL, 300,000 ppm) within 50 feet of the building footprint (Eklund, 2010).
3) Residential reuse (methane detected at or above 1.25%bv (25% of LEL, 12,500 ppm) and no static pressure detected) will require a minimum of a passive mitigation system, to be prepared by a qualified and demonstrated landfill gas expert and approved in advance in writing by DEQ. The implementation of an active mitigation system will be made on a site specific basis.

Note: Townhomes are not permitted on sites where methane is a concern per the NC DEQ Brownfields Townhome Minimum Requirements (December 20, 2019)

Note: Redevelopment using Podium construction where there is open air parking below all residential dwellings *may* obviate these thresholds and guidelines other than the townhome prohibition above. Consult the program for further information.

General Mitigation System Guidelines for the Program include the following unless DEQ is otherwise satisfied by the site-specific design, installation and monitoring provided by said pre-qualified PE:

- A spray applied membrane shall be incorporated into any methane mitigation design.
- Measurable static pressure greater than atmospheric or methane concentrations greater than or equal to 1.25%bv (25% LEL, 12,500 ppm) methane will require a passive mitigation system.
- When methane concentrations are present greater than or equal to 1.25%bv (25% LEL, 12,500 ppm) and static pressure is greater than 0.018 PSI [0.5 inches of water] an active mitigation system will be required.

- Pre and Post Occupancy Sampling shall be conducted on a site specific basis in accordance with a DEQ approved work plan provided by said PE to include confirmation samples, indoor air monitors, on-going sampling, etc.
- Long Term Monitoring Requirements – confirmation samples (manual sample collection), indoor air monitors (automated), routine sub-slab monitoring, etc. will be required as part of a methane mitigation plan for redevelopment in accordance with the ongoing monitoring requirements section below.

Ongoing Monitoring Requirements

- Automated indoor air/vent riser monitors/alarms:
    - A concentration of 10% LEL CH_4 shall trigger an internal notification to the designated property owner representative who will initiate an investigation into the cause of the alarm.
    - A concentration of 25% LEL CH_4 shall trigger an audible alarm system within the building, a mandatory evacuation of the building, and a notification to the local fire and health departments and DEQ. Occupancy of the building will not resume until the concentration of methane are reduced and confirmed by a certified environmental professional.
- Field measurements of sub-slab monitoring locations and inspections of alarm system components (to be defined in a DEQ approved work plan) shall occur at a minimum frequency of:
    - Once per month for the first three months (County of Los Angeles California, 2020) following occupancy approval and until three consecutive sampling events demonstrate effective operation of the mitigation system and quarterly thereafter;
    - Monitoring requirements may be reduced in the event that future remediation/monitoring of the source area demonstrates attenuation of the methane source.

Other design considerations to be included in Mitigation Proposal

In addition to the *General Mitigation System Guidelines* specific to planned site redevelopment outlined above, the below design considerations should be included, as applicable, in mitigation design submittals for consideration by the NC DEQ Brownfields Program, including but not limited to:

- Impervious Surfaces/Exterior Site Features
- Venting Galleries: Active/Passive
- Utility Conduits and Preferential Pathways: Onsite/Offsite
- Impact of methane source generating material on pressure gradient advection into planned site buildings
- Effectiveness measures of any planned removal of organic materials (i.e. pilot testing and long term monitoring)
- Methane hotspots in soil vapor and sampling grid spacing for detection of such.

References

Agency for Toxic Substances & Disease Registry. U.S. Department of Health and Human Services. 2001. *Landfill Gas Primer – An Overview for Environmental Health Professionals*. November 2001. https://www.atsdr.cdc.gov/HAC/landfill/html/intro.html

California Department of Toxic Substances Control (CA DTSC). 2005. *Advisory On Methane Assessment and Common Remedies at School Sites*. 16 June 2005. http://www.hawaiidoh.org/references/CalEPA%202005b.pdf

County of Los Angeles California. 2020. *Gas Hazard Mitigation Policy and Standards.* California Building Code. Vol. 1, Title 26. Los Angeles County Code. 1 January 2020. https://dpw.lacounty.gov/epd/swims/docs/pdf/methane/Methane%20Packet.pdf

Eklund, B. 2011. *Proposed Regulatory Framework for Evaluating the Methane Hazard due to Vapor Intrusion*. URS Corporation. 1 February 2011. https://www.provectusenvironmental.com/marketing/tech_docs/Proposed_Regulatory_Framework_for_Evaluating_Methane_Hazard_due_to_Vapor_Intrusion-Eklund.pdf.

Eklund, B., Sepich, J., and Legrand, R. 2014. *Procedures for Evaluating Potential Methane Hazard at Vapor Intrusion Sites.* Paper #10. Vapor Intrusion, Remediation, and Site Closure Conference, Cherry Hill, NJ. September 10-11, 2014. https://www.provectusenvironmental.com/marketing/tech_docs/Procedures_for_Evaluating_Potential_Methane_Hazard-Eklund2014.pdf

Florida Department of Environmental Protection (FDEP). 2019. *Guidance for Disturbance and Use of Old Closed Landfills or Waste Disposal Areas in Florid*a. Rev. 2.3. 2 March 2019. https://floridadep.gov/sites/default/files/Old_Dump_Guidance-02Apr2019.pdf

Geosyntec Consultants, Inc. 2020. Personal Correspondence. 7 July 2020.

Geosyntec Consultants, Inc. *Engineered Vapor Protection System Allows Brownfields Redevelopment of Closed Landfill as Home Depot Retail Site*. Accessed 7 July 2020. https://www.geosyntec.com/projects/item/775-engineered-vapor-protection-system-allows-brownfields-redevelopment-of-closed-landfill-as-home-depot-retail-site

Geosyntec Consultants, Inc. 2018. *The Many Challenges of Brownfields Redevelopment at Former Landfills: Two Recent Case Studies on Florida's Treasure Coast*. Florida Brownfields Association 2018 Annual Brownfields Conference. Accessed 7 July 2020. https://www.floridabrownfields.com/assets/2018Conference/Presentations/Heidt%20FBA_2018_Challenges_Brownfields_Former_Landfills_Final_10_1.pdf

Hamilton. D.H., and Meehan, R.L. 1992. Cause of the 1985 Ross Store Explosion and Other Gas Ventings, Fairfax District, Los Angeles. Engineering Geology Practice in Southern California, Association of Engineering Geologists, Special Publication No. 4, 1992. http://web.stanford.edu/~meehan/class/ce2942001/rosspaper.htm

Land Science Technologies, REGENESIS, Inc. *Multi-Residential Project Moves Forward Using Geo-Seal as an Effective Barrier to Protect Against Methane Concerns.* Accessed 8 July 2020. https://landsciencetech.com/wp-content/uploads/2017/05/Land-Science-Geo-Seal-Project-w-Modern-Geosciences.pdf

Los Angeles Department of Building and Safety (LADBS). 2010. *Methane Hazard Mitigation Measures Standard Plan.* Rev. 8 March 2010. https://www.ladbs.org/services/core-services/plan-check-permit/methane-mitigation-standards

Los Angeles Department of Building and Safety (LADBS). 2014. *Site Testing Standards for Methane.* Doc. LABC 7104.1. Rev. P/NC 2014-101. https://www.ladbs.org/services/core-services/plan-check-permit/methane-mitigation-standards

New Jersey Department of Environmental Protection (NJDEP), Division of Solid and Hazardous Waste, Bureau of Solid Waste Permitting (BSWP) and the Office of Brownfield and Community Revitalization (OBCR). 2020. Personal Correspondence. 28 July 2020.

New Jersey Department of Environmental Protection (NJDEP), Site Remediation and Waste Management Program. 2016. *Landfills Investigation Technical Guidance. Version. 1.3.* https://www.nj.gov/dep/srp/guidance/srra/landfill_guidance.pdf?version_1_3

New Jersey Department of Environmental Protection (NJDEP), Division of Solid and Hazardous Waste. 2017. *Solid Waste Regulations. N.J.A.C 7:26, Subchapter 2A. Additional Specific Disposal Regulations for Sanitary Landfills.* https://www.nj.gov/dep/dshw/resource/26sch02a.pdf

North Carolina Department of Environmental Quality (NCDEQ), Division of Waste Management, Solid Waste Section. 2010. *Landfill Gas Monitoring Guidance.* https://files.nc.gov/ncdeq/Waste%20Management/DWM/SW/Field%20Operations/Environmental%20Monitoring/LandfillGasMonitoringGuidanceDocument.pdf

Ohio EPA, 2020. Personal Correspondence. 26 June 2020.

Ohio EPA. 2017.*Ending Explosive Gas Monitoring for Solid Waste Landfills that Ceased Accepting Waste Prior to June 1, 1994*. December 2017. https://epa.ohio.gov/portals/34/document/guidance/Ending%20EG%20Monitoring%20GD.pdf

Orange County Fire Authority. 2000. *Development and Land Use Guideline for Combustible Soil Gas Hazard Mitigation, Guideline C-03*, Planning and Development Services Section, 1.31.2000. https://www.ocfa.org/Uploads/CommunityRiskReduction/OCFA%20Guide-C03-Combustible%20Gas.pdf

Riverside County Health Services Agency, Department of Environmental Health. 2001. *Methane Mitigation Protocol (Vacant Lots).* 27 July 2001. http://rivcocob.org/proceeds/2010/p2010_05_25_files/03_53001part10.pdf

SCS Engineers, Inc. 2020. Personal Correspondence. 13 May 2020.

Scottish Environment Protection Agency (SEPA). 2002. *Guidance on Landfill Gas Flaring.* Environment Agency. https://www.sepa.org.uk/media/28988/guidance-on-landfill-gas-flaring.pdf

Sway Features. Los Angeles, Ca. 2020. Personal Correspondence. 11 May 2020 and 2 July 2020.

US Environmental Protection Agency (EPA). 2012. *40 Code of Federal Regulations Part 258.23 [Resource Conservation and Recovery Act Subtitle D]. Criteria for Municipal Solid Waste Landfills, Explosive Gases Control.* 1 July 2012. https://www.govinfo.gov/content/pkg/CFR-2012-title40-vol26/xml/CFR-2012-title40-vol26-part258.xml

Wiley III, J.B. and Asadi, B. 2002. *Redevelopment Potential of Landfills. A Case Study of Six New Jersey Projects.* WIT Press, Ashurst Lodge, Southampton, SO40 7AA, UK. https://www.witpress.com/Secure/elibrary/papers/BF02/BF02004FU.pdf