Mireya Turner

From: Margaux Kambara Tom Lajcik <Thrive95453@outlook.com>
Sent: Tuesday, February 3, 2026 7:39 PM
To: Mireya Turner
Subject: [EXTERNAL] Setback distances based on the inverse square law.

Mireya,

Thank you again for allowing me to share a fact-based way of thinking about cannabis setbacks using the inverse-square principle.

The inverse square law

In simple terms, the inverse-square law describes how the intensity of something that spreads outward from a source—such as sound, light, energy, or airborne odor—drops rapidly as distance increases. As the distance from the source doubles, the exposure is reduced to roughly one-quarter; if the distance triples, the exposure drops to about one-ninth, assuming similar conditions and no major barriers or amplification effects. This same physical principle is widely used in fields ranging from acoustics and lighting design to environmental exposure and public-health risk assessment, because it reflects how dispersing energy or emissions naturally dilute in space. For land-use planning, it provides a transparent and defensible way to understand why distance is such a powerful and practical tool for reducing off-site impacts.

The inverse-square principle can be combined with the size or emission strength of a project to estimate an appropriate setback. A larger cultivation area, higher plant count, or higher-emitting operation effectively acts as a stronger source, meaning the starting intensity of odor (or other off-site effects) is higher at the property line. Because intensity decreases with the square of the distance, maintaining a consistent and tolerable impact threshold requires that setbacks increase as the source becomes larger or more concentrated. In practical terms, this allows planners to scale setbacks to project size: if the emitting area or activity increases, the distance needed to keep off-site exposure below a nuisance threshold must also increase to achieve the same level of reduction. This provides a rational, defensible way to link allowable project size and required setbacks so that off-site impacts remain comparable and acceptable for neighboring properties.

Using this principle, the setbacks can be calculated as follows;

Let:
$A_{baseline}$ = Baseline Area
$D_{baseline}$ = Baseline Setback
$A_{proposed}$ = Proposed Canopy Area
$D_{required}$ = Required Setback Area

Formula:

$$D_{required} = D_{baseline} * ((A_{proposed} / A_{baseline})^{0.5})$$

How this looks based on the setbacks originally proposed

Type	Size	Unit of Measure	Sq. Foot Conversion	Size Relative to 10,000 sq. ft. Baseline Area	Setback (200ft Baseline for 10,000 sq. ft.)	Setback (800ft Baseline for 10,000 sq. ft.)	Setback (1000ft Baseline for 10,000 sq. ft.)
	5,000	square feet	5,000	0.50	141	566	707
	10,000	square feet	10,000	1.00	200	800	1000
	22,000	square feet	22,000	2.20	297	1187	1483
	1	Acre	43,560	4.36	417	1670	2087
	5	Acres	217,800	21.78	933	3734	4667
	10	Acres	435,600	43.56	1320	5280	6600
	20	Acres	871,200	87.12	1867	7467	9334

Other Points of Discussion

Lived experience

As I mentioned a few times, I live near two 10,000 sf canopy grows — one is about 1400 ft from my home and the other about 800 feet from my home. From lived experience, I almost never smell the grow that is 1400 feet from my home but the grow 800 feet away is "barely tolerable". Anything closer would be unlivable. This is where the 10,000sq. ft. At a distance of about 800ft as a proposed baseline comes from.

Thiols and Turpenes

Cannabis odor is produced by two primary classes of compounds—terpenes and thiols—and it is important to distinguish their very different roles when considering setback policy.

Terpenes (such as myrcene, limonene, and pinene) contribute the familiar herbal and citrus notes of cannabis and are typically detectable at very low parts-per-billion concentrations.

More recent research shows, however, that the sharp, skunky and most intrusive character of cannabis odor is driven primarily by a small group of volatile sulfur compounds known as thiols. Thiols are among the most powerful odorants known, with human detection thresholds commonly in the parts-per-trillion range, allowing them to remain noticeable and objectionable even after extreme atmospheric dilution.

Importantly, thiols are also the same class of compounds associated with odors from rotting organic matter, carcasses, sewage, and stagnant or fetid water—odors that humans instinctively associate with contamination, harm, and danger. As a result, exposure to thiol-dominated odors can trigger heightened annoyance and physiological stress responses even at extremely low concentrations.

In practical terms, while terpene odors tend to dissipate relatively quickly with distance, thiols can drive persistent off-site nuisance and stress at much greater distances, particularly under nighttime and stable air conditions, making distance-based setbacks the most reliable means of protecting nearby residents.

Comparisons to other agricultural odors

While it is sometimes said that "agriculture smells and people should simply get used to it," the available odor research does not support treating cannabis cultivation as equivalent to ordinary, dispersed farming activity.

Odor standards for cannabis have not yet been formally established and published estimates vary. However, peer-reviewed odor assessment and impact-evaluation literature has recognized that commercial cannabis cultivation can function as a high-intensity odor source comparable to other regulated agricultural odor sources (Capelli et al., 2022).

More specifically, a peer-reviewed review of community-scale air quality and odor impacts from cannabis cultivation reports that a commercial cannabis facility containing on the order of 1,500–2,000 flowering plants can produce odor emission strengths comparable to those of a livestock operation such as a swine or poultry facility (Monticelli et al., 2022, *Environmental Science & Technology*). Importantly, this comparison is made to operations that fall within the category of CAFOs—Concentrated Animal Feeding Operations, which are large, confined livestock facilities that are specifically regulated because their odors and air emissions are known to cause off-site impacts. The agricultural odor literature further shows that, on a per-animal and per-building basis, swine facilities frequently emit higher odor emission rates than dairy cattle operations, and poultry facilities are likewise recognized as significant odor sources.

This distinction matters for land-use policy because a cannabis cultivation site concentrates hundreds or thousands of high-emitting plants at a single, fixed location, making its odor behavior far more analogous to regulated swine, cattle, or poultry CAFOs than to dispersed, low-intensity agricultural activity such as open pasture. In this context, treating cannabis odor as something neighbors should simply "get used to" overlooks the fact that similarly concentrated agricultural odor sources are already subject to regulatory controls and separation distances specifically intended to prevent nuisance and community-level impacts.

Hope this helps.

Please let me know if you have any questions.

Thanks!

Tom

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