Washington State
Liquor and Cannabis Board

Research Brief
Cannabis Pesticide Testing
September 2025

LCB Research Program
The Research Program at the Washington State Liquor and Cannabis Board (LCB) is a non-partisan, transparent resource focused on public health and safety outcomes related to the products, policy, and regulation of alcohol, cannabis, tobacco, and vapor products.

Purpose
Partners from regulatory and research organizations frequently request information about cannabis pesticide testing in Washington State. The LCB has also received requests about research related to pesticide remediation. Pesticide testing is an important part of quality control testing required for all legal cannabis grown, processed, and sold in Washington.

This brief is based on a review of existing evidence including scientific literature, government reports, regulations, policies, and other credible information sources. It also includes input from several state agencies in Washington, Oregon, and California.

This document does not represent an official position of LCB.

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For more information about the Research Program and its work, please visit: lcb.wa.gov/research_program.

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Background

Like other plants and crops, cannabis can be affected by pests and diseases that impact crop health and quality. Because of this, cannabis producers may use pesticides to manage this risk and improve overall crop growth and yield.[1]

Pesticides are typically applied to cannabis plants during cultivation. Pesticide residues then remain on harvested plants and in the final product (e.g., dried flower, concentrates, edibles, etc.).[2] Pesticides can also be unintentionally introduced to cannabis via other pathways, such as through contaminated water or soil, drift from other nearby agricultural operations, and from cross-contamination during processing (e.g., during the manufacturing of concentrates).[3]

Regulatory Landscape in the U.S.

Cannabis is not federally legal and therefore is not studied or regulated by federal agencies. As a result, the U.S. Environmental Protection Agency (EPA), which approves and registers pesticides for agricultural uses, has not registered any pesticides for cannabis or issued guidance for pesticide use in cannabis. The EPA also requires toxicological data and human health risk assessments to set limits for pesticide residues in food. Similarly, the U.S. Department of Agriculture (USDA) monitors pesticide residues in food commodities, but not in cannabis.

In addition, medical cannabis does not have safety oversight from the U.S. Food and Drug Administration (FDA). This lack of federal oversight has left cannabis pesticide regulation up to states with legal, regulated cannabis markets.[1-3]

Among the states with legal cannabis markets, there is wide variation in how pesticides are regulated. Generally, there are two categories of cannabis pesticides in state regulations:

1. A list of pesticides that are allowed to be used on cannabis during production. These lists are created and updated by the state agriculture agency and include pesticides that have been reviewed by the EPA for use on general food crops, as well as minimum-risk pesticides (e.g., naturally occurring) that are exempt from EPA limits. In Washington State (WA) there is a list of 319 allowed pesticides.

2. A list of pesticides that must be tested by approved laboratories before being sold in retail stores. Each pesticide has a specific regulatory limit (also known as an action level), and the results of lab tests must be reported to state regulatory agencies. Most states with legal markets require testing for about 40-60 pesticides; WA has a list of 59 pesticides. If tests fail (i.e., the pesticides detected are above the action level) the cannabis is not allowed to be sold.

Lack of Human Health and Safety Research

Although states have created these pesticide regulatory frameworks, there is a lack of research on the

human health and safety of pesticides in cannabis. No pesticides have been specifically tested and approved for use on cannabis plants, nor have they been tested for human toxicity for the different ways in which cannabis products are used (e.g., inhaled). This has resulted in the lists of pesticides required to be tested in a lab to be primarily based on the ability to detect pesticides and not on human health and safety.

Many of the pesticides used on cannabis have been evaluated by the U.S. EPA for human health and safety on other food crops. Several have been classified by the World Health Organization as moderately hazardous for human consumption and have been linked to harmful health outcomes such as cancer, neurological problems, and developmental and reproductive toxicity.[4-6] However, pesticide exposure from cannabis use is quite different from food crops because most cannabis users inhale products rather than eat them, and inhalation allows for more direct absorption into the bloodstream.[7]

Although pesticide exposure data exists for tobacco products, cannabis users typically inhale larger volumes of smoke and hold inhalations for longer in the lungs, which greatly limits comparisons to tobacco users.[2] One study analyzed pesticide levels in cannabis smoke and found that 10-70% of the pesticide residue from the cannabis flower transfers into the smoke (and then the user).[6] The burning of pesticides when cannabis is smoked may also create toxic byproducts, which is challenging to study since smoking and/or vaping cannabis can happen at different temperatures.[2,3,8]

Pesticide exposure may also differ depending on complex patterns of cannabis use, including route of administration (e.g., smoked, vaped, or eaten), frequency of use, and duration of use.[2,3,5]

Since legal cannabis markets are still relatively new, understanding impacts and trends from real-world exposures will take time to explore. Researching cannabis as described above is challenging because cannabis is still a Schedule 1 substance at the federal level, which limits scientific research on this topic. This means that no comprehensive evidence-based guidelines exist for best practices on testing for pesticides in cannabis to protect human health.

State Regulations for Pesticide Testing in Cannabis

Despite limited human health and safety testing for pesticide use in cannabis, it is widely understood that pesticide exposure should be limited.[5]

Most states with legal cannabis markets require testing for about 40-60 pesticides, but the number and action levels (regulatory limits) vary greatly.[1,9] States have created lists of pesticides required for testing and action limits for the specific pesticides. They use a few approaches, sometimes using more than one approach.

1. Adopt pesticide limits from the U.S. EPA list of registered

pesticides (developed for food products).

2. Use analytical criteria, including the limit of detection (LOD), or the lowest concentration that can be detected, and/or the limit of quantification (LOQ), or the lowest concentration that can be accurately measured.

3. Develop a more complex set of criteria and use additional data (e.g., human toxicity) to assess each pesticide and set specific action levels for each one.

For example, the Oregon Health Authority (OHA) created a scoring process across four parameters that included input from an expert work group (**Figure 1**).[10] The resulting OHA list of 59 pesticides was subsequently adopted by Washington and other states.

The California Department of Pesticide Regulation (DPR) has also independently assessed pesticides to inform regulatory action levels. Notably, DPR has conducted research and recommended pesticide action levels based on whether the product is intended for inhalation (smoke or vape) or ingestion (edibles).[11] This is a major step forward in establishing regulatory limits that are based on real-world cannabis use which needs further research and investigation.

Figure 1. Oregon Health Authority (OHA) scoring process used for developing its pesticide list and action levels.[10]

	Low (0) → Priority to keep on list → High (3)			
	0	1	2	3
General toxicity	No data	*Fungicides*, plant growth regulators	Pyrethroid, neonicotinoid, pyrazole and pyrimidine, and macrocyclic lactone insecticides and *acaricides* and insect growth regulators	*Organophosphate*, organochlorinated and *carbamate* insecticides.
Analytical capability	Not tested	Expensive and/ or analytically challenging to test in cannabis	Some labs said feasible, other labs said not feasible	Multi-instrument, "easy" clean-up, all labs in agreement
Detection frequency (in cannabis)	Tested but never detected	Not tested	Single detection	Multiple detections
Availability	Not available or ODA experience suggested this analyte would not be used or detected in cannabis	Restricted use pesticide registered for a single crop or use	Restricted use pesticide registered for multiple crops or uses	General use pesticide (no license or other certification needed to purchase or use products with this active ingredient); ODA knowledge that the analyte is frequently used illegally and likely to be used on cannabis

The Cannabis Testing Process

Lab testing requirements for cannabis include much more than pesticides.

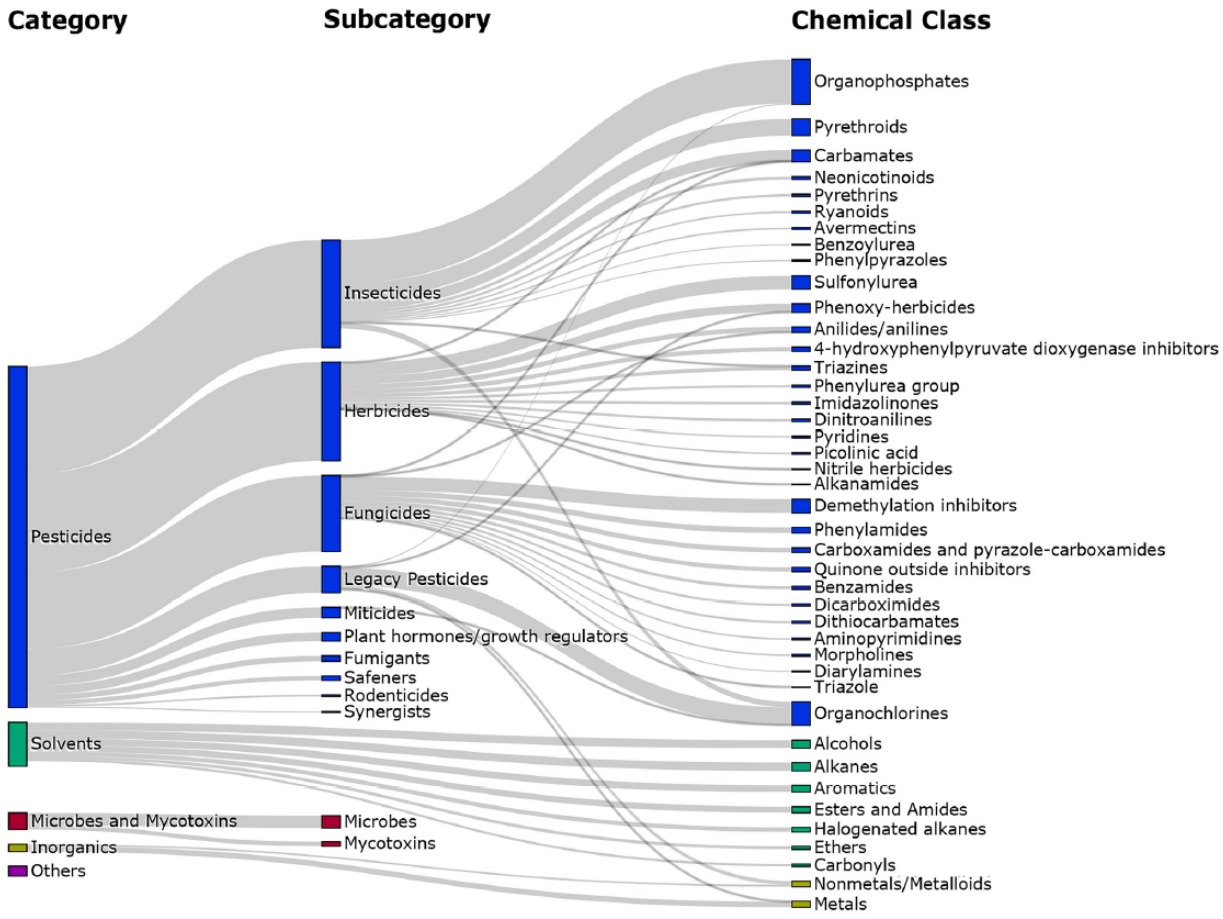
There are two broad categories: naturally occurring plant compounds (e.g., Δ^9-tetrahydrocannabinol [THC], cannabidiol [CBD], terpenes) and potential plant contaminants (e.g., pesticides, residual solvents, microbes, heavy metals; **Figure 2**).[1]

Generally, cannabis testing requires a producer and/or processor to send a representative sample from harvested flower (buds or leaves) or processed products to an approved third-party lab for testing. The test results are reported to the producer and/or processor and the state regulatory authority. If the sample passes all required testing, then it is allowed to be sold in retail stores. If it fails, there are a few options, depending on the contaminant and the state. These include retesting, remediation (i.e., treating or reprocessing the product to remove contaminants), or destruction.

Pesticide Testing Failures

There are limited studies that have documented the failure rates of cannabis pesticide testing. A 2022 study examining California testing records identified an overall failure rate of 5% across all contaminants, with extracts failing more than four

Figure 2. Regulated contaminant categories in cannabis.[1]



times as often as flower.[1] In that study, pesticides were the most common reason for failure out of all compliance testing records.[1] Oregon has documented pesticide failure rates between 1% and 4% since 2016. A few other states have reported failure rates between 1-5%.[12] In Washington State, the Cannabis Central Reporting System (CCRS) has shown a much lower failure rate of pesticides, between 0.01% and 0.03%, from 2022 to 2025.

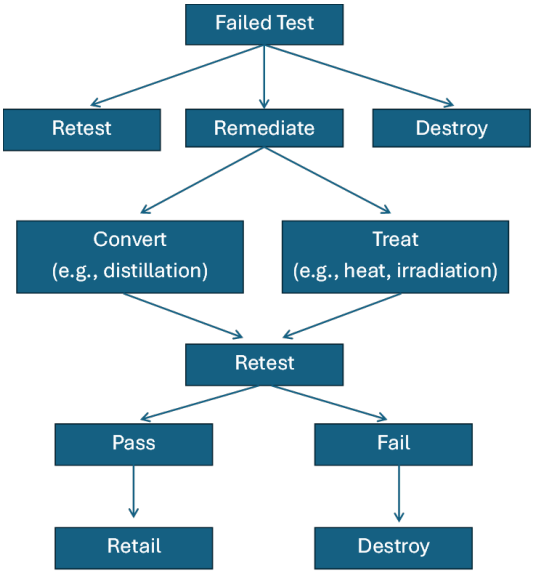
More research is needed to determine why Washington State has reported a substantially lower pesticide failure rate compared to other states, but reasons may include high quality cannabis, differences in lab testing procedures, systems related to cannabis reporting, and various rules and regulations. The extent to which these factors may contribute to the lower failure rate are outside the scope of this research brief.

Failed Tests and Remediation

If a cannabis lab test fails, options may include retesting, destruction, or remediation (**Figure 3**). Cannabis remediation is a post-harvest process that removes contaminants to ensure the harvested flower or other processed cannabis products meets regulatory standards (e.g., heat, irradiation).[13]

Remediation may be appropriate when the contaminant can be safely removed without compromising the product quality or when the contaminant naturally degrades to safe levels over time. A general critique of remediation is that it can degrade cannabinoids, resulting in subpar products, and it can potentially create other unknown byproducts.[14]

Figure 3. Potential pathway(s) for cannabis samples after a failed test.



States including Washington do not require labeling to inform consumers that the product they are buying has been remediated.[14,15]

Most states allow remediation for some contaminants, such as residual solvents and microbials.[16] For example, one industry estimate is that 10-20% of commercially grown cannabis fails microbial testing, indicating that remediation is needed in some circumstances. If remediation is allowed, most states do not specify remediation methods, but they generally require notification and/or documentation of the process, as well as retesting after remediation is completed.[16,17]

Although remediation is allowed for some contaminants (e.g., microbials,

residual solvents), most states, including Washington, do not allow for remediation of pesticides. Pesticides are different from other contaminants like microbes because they can absorb more readily into plant tissue and cannot always be easily removed without damaging the product.[18]

For example, a recent rulemaking process in Washington, D.C. concluded that *"no remediation is permissible when a substance fails a pesticide test as the Board is aware of no safe means to address this issue."*[19] Other states, including California and Colorado have also taken the stance that remediation of pesticides is strictly prohibited.

One notable exception is Oregon, which allows remediation for two specific types of pesticides, pyrethrins and piperonyl butoxide (PBO).[20,21] Oregon determined that these two pesticides may be remediated based on input from the Department of Agriculture since Oregon allows their use on cannabis during production, and they can be remediated using a simple approach (exposure to sunlight or ultraviolet rays).

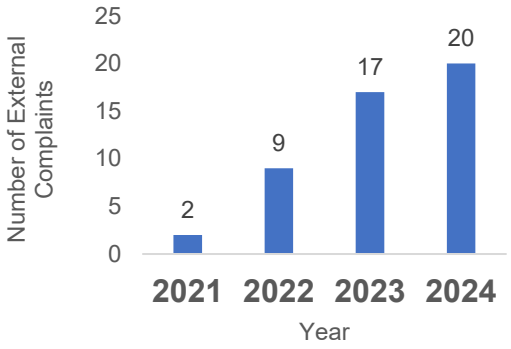
According to the National Pesticide Information Center, both pyrethrins and PBO are very common (found in over 2,000 pesticide products), they break down rapidly in the presence of sunlight, and they are low in toxicity to humans. However, studying these pesticides is complex for many reasons, including that PBO is always combined with other pesticides.[22,23]

Other Detection of Pesticides in Cannabis Products

Other than lab testing, independent research has detected pesticides in retail cannabis products.[7] Prior to mandated pesticide testing requirements in Washington, one study examined 26 samples of cannabis products (mostly concentrates). Of those, 85% tested positive for pesticide residues, with some exceeding the upper limit of lab measurement capabilities.[7]

Since 2021, the Washington State Liquor and Cannabis Board (LCB) has received 54 external pesticide-related complaints (**Figure 4**).

Figure 4. Number of external LCB complaints related to pesticides.



Also since 2021, LCB enforcement officers have recorded 70 cases of pesticide non-compliance (violations) for either quality control testing failures or intentional use of unauthorized pesticides; these investigations resulted in 38 verbal warnings, 25 written warnings, and seven fines.

Washington State Regulations

In Washington State, pesticide testing for cannabis became required in 2022. There are several agencies across the state that have regulatory

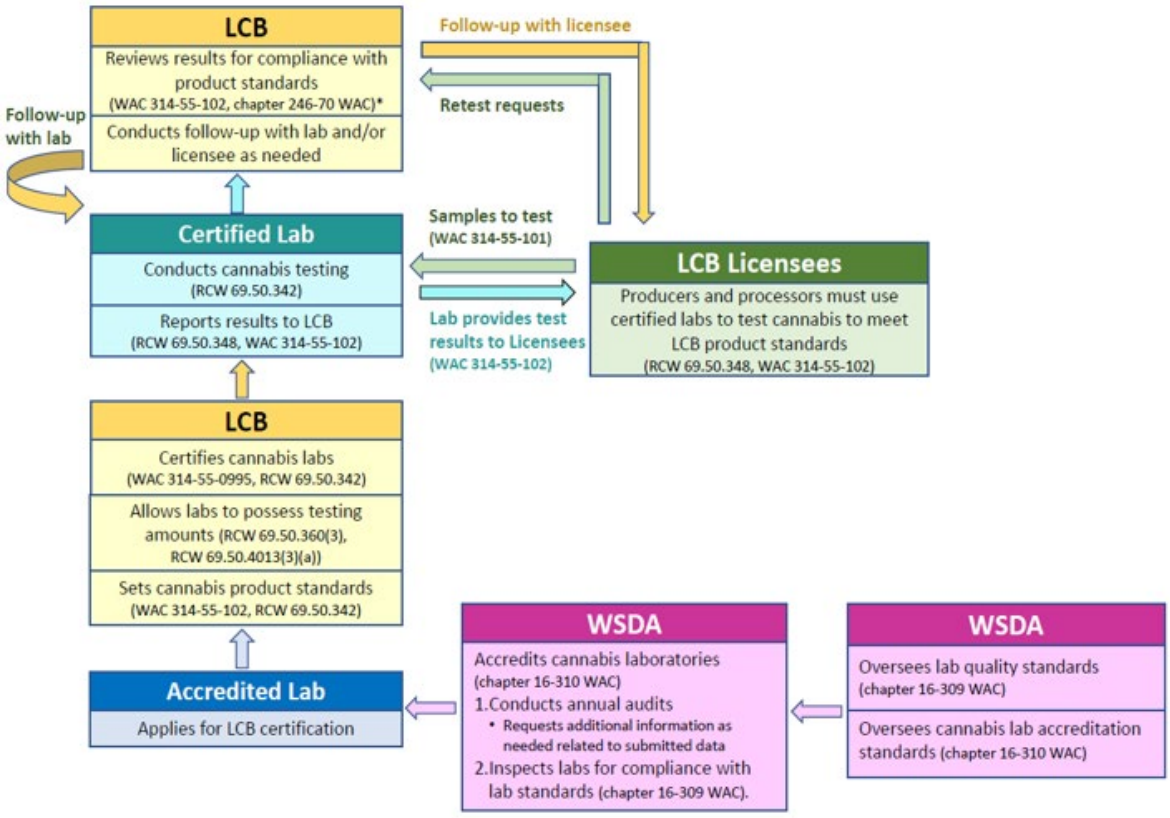
oversight including the Liquor and Cannabis Board (LCB), the Department of Agriculture (WSDA), and the Department of Health (DOH) (**Figure 5**). Representatives from each agency comprise the Cannabis Lab Analysis Standards Program (CLASP) and meet regularly to develop, revise, and update laboratory quality standards.[24]
For pesticide use in cannabis, WSDA developed a set of criteria to establish a list of approved pesticides and is responsible for updating this list for cannabis growers.[25] The WSDA also oversees lab quality standards and accreditation.

The LCB is responsible for setting and enforcing quality control testing for cannabis products, including mandatory pesticide testing. The LCB's rules outline which tests are required (WAC 314-55-102), the action levels for contaminants (WAC 314-55-108), and that failed pesticide tests are not allowed to be remediated and must be destroyed (WAC 314-55-102(6)(c)).

The DOH oversees the medical cannabis program, which requires additional lab testing beyond the requirements for non-medical cannabis (i.e., heavy metals testing).[24,25]

Industry Concerns
The concerns of industry members include that the sampling and analysis required for pesticide testing

Figure 5. Regulatory oversight of cannabis testing laboratories in Washington State.[24,25]



is complex and costly. It also requires advanced instrumentation and highly skilled laboratory staff.[2,3,8] Pesticides have high variability in physical and chemical properties, meaning that testing requires several different analytic techniques (e.g. liquid and gas chromatography, mass spectrometry, etc.) further increasing the cost and complexity of testing.[2,3]

Regulatory Challenges

The complexity of pesticide testing could result in several ongoing regulatory challenges and risks, such as:

- A limited number of labs with the capability to meet lab standards and conduct the many required tests.
- A limited number of producers and/or processors who can easily comply with testing requirements for their products.
- A concern that there is "lab shopping" in the cannabis market, where businesses seek out labs that have more "lenient" practices.
- Problems with missing, inaccurate, or fraudulent reporting of test results in state tracking systems.

Summary

Pesticides are an essential part of cannabis agriculture, and lab testing for pesticide residues is intended to help ensure safe cannabis products. However, the pesticides required to be lab tested are primarily based on the ability to detect pesticides and not on research related to human health and safety. There is lack of research on the human health and safety of pesticides in cannabis; no pesticides have been specifically tested and approved for use on cannabis plants, nor have they been tested for human toxicity for the different ways in which cannabis products are used (e.g., inhaled).

This is a critical research gap that needs to be further explored in both toxicological and epidemiological research prior to developing evidence-based regulations regarding which pesticides are allowable and at what action levels.

Pesticide remediation is a post-harvest process aimed at removing or reducing harmful pesticide residues from products after they have failed initial lab testing. However, pesticide remediation is generally not supported by the current available evidence. Most states have prohibited pesticide remediation for cannabis products. If a product tests above the action level set by the state, the product is not allowed to be sold. Oregon is an exception to this as it allows remediation for two specific pesticides that can be remediated by exposure to sunlight.

In Washington State, data reported by cannabis licensees through the Cannabis Central Reporting System (CCRS) suggest that changes in rules to allow for remediation of pesticides may not be warranted due to the low rates of reported pesticide failures. If the actual rates of pesticide failure are greater than current reports, it indicates larger reporting issues that may need to be examined before opening the state's rules processes related to remediation, particularly

because there is limited evidence supporting this use case.

Future Considerations and Opportunities

- Coordinate a national collaboration of toxicologists and health researchers to develop health-based cannabis pesticide regulations, including revising pesticide action levels based on different exposure pathways (e.g., inhalation vs. ingestion).
- Improve consumer education so people can make informed decisions about products they choose to buy and use, including where to find information about cannabis testing (e.g., many states including Washington require the certificate of analysis to be made available upon request).
- Require additional labeling and transparency for cannabis pesticides and other additives and treatments used during production, including indicating if/how a product has been remediated.
- Provide resources for cannabis producers/growers to adopt more comprehensive strategies that reduce reliance on pesticides.
- Conduct risk assessments for vulnerable populations at higher risk of exposure. For example, some studies indicate medical cannabis patients are at increased risk for harm and should be cautious when using cannabis.[1,9]
- Validate if reporting methods represent accurate pesticide failure rates in Washington State.
- Establish a state reference lab with a research database to help develop and verify lab standards and testing results.

Suggested Citation

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