PRELIMINARY TECHNICAL REPORT:

Evaluating Compliance, Potency, and Pesticides in Oregon's Marijuana and Hemp Markets Ten Years after Legalization

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EXECUTIVE SUMMARY

The Oregon Liquor and Cannabis Commission (OLCC) conducted a review of an array of current regulatory concerns in the context of a look back at the last 10 years since legalization of marijuana. The review primarily focused on THC levels in hemp flower and edibles, packaging and labeling of hemp products, and pesticide and potency testing of hemp and marijuana flower. In collaboration with the Oregon Department of Agriculture (ODA), OLCC collected 151 samples of cannabis products to conduct a survey of hemp and marijuana products currently being sold in Oregon. OLCC staff compared the current packaging and labeling of hemp products to the marijuana products OLCC currently regulates. ODA's Cannabis Reference Laboratory (CRL) conducted pesticide and potency testing on the samples collected to assist the OLCC in investigating concerns of contamination and product misrepresentation.

- OLCC staff were able to successfully purchase a large amount of prohibitively high THC cannabis flower and edible products from internet retailers and unlicensed retail stores.
- Based off the seller's label and website claims, 78% (40 of 51) of hemp flower samples successfully purchased for this mission were prohibited for sale to an Oregon consumer, 8% (4 of 51) contained "artificially derived cannabinoids" (defined below), and 73% (37 of 51) exceeded 0.3% total THC; **however**
- **All 51 samples of hemp flower tested by the CRL exceeded 0.3% total THC.** Based on these tests results, all this flower is prohibited for sale to Oregon consumers, ranging from 0.4% to 30.5% total THC.
- 72% of hemp edible samples successfully purchased (36 of 50) were prohibited for sale to an Oregon consumer based on the amount of delta-9-THC they claimed to contain or the presence of artificially derived cannabinoids.
- 91% (30 of 33) of hemp edible samples and 87% (41 of 47) of hemp flower samples purchased online were sold without adequate age verification.
- ODA pesticide audit testing resulted in the discovery of a batch marijuana being found to have a pesticide **nearly 10× the action level** that was being sold to consumers. OLCC worked with the licensee to immediately recall the product.
- Only 10% (5 of 50) of hemp edibles purchased have clear potency on the label that were traceable to test results.
- The vast majority of the hemp products purchased for "Operation Clean Leaf" were sold without appropriate age verification.

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INTRODUCTION: TEN YEARS OF LEGALIZATION

In 2014, the citizens of Oregon voted to pass Ballot Measure 91,[1] legalizing the possession and use of marijuana by adults. This ballot measure tasked OLCC to create a well-regulated adult use market for marijuana. In the ten years since legalization, the laws and rules that govern cannabis within Oregon and nationally have continued to evolve at a rapid pace.

With the passage of the Agriculture Improvement Act of 2018 (also known as the 2018 Farm Bill),[2] hemp products have experienced a surge in market size and popularity across the United States. While the intent of this legislation was to legalize hemp and launch an industry for non-intoxicating products made from hemp grain and fiber, the language of the Act opened the door for a wide variety of intoxicating cannabis-derived products to be sold nationwide by claiming to fall under the federal definition of "hemp."

The growing popularity of hemp-derived edible products has led to a proliferation of new products in Oregon's market. Among these, hemp gummy edibles standout as one of the most widely available and consumed products. As the industry has expanded, so too has the need for regulatory oversight to ensure that these products do not pose unnecessary risks to public health and safety. In 2024, Oregon House Bill 4121[3] tasked OLCC with overseeing the establishment of a hemp product registry. Among other things, the hemp product registry requires the establishment of certain labeling standards and verification of compliance with existing testing requirements for hemp products sold in the "general market" (i.e. not at an OLCC-licensed marijuana retailer).

Despite legalizing marijuana, illegal cultivation of cannabis has continued to be a persistent issue in Oregon. In 2021 OLCC and ODA worked with many other state and local agencies to combat a significant number of illicit marijuana grows, particularly in Southern Oregon, which were discovered to be operating under the guise of legal hemp cultivation (OLCC, 2021).

OLCC is continuing to identify and work proactively on addressing regulatory challenges in the cannabis industry, including concerns about monitoring pesticide use in cannabis cultivation, the emergence of intoxicating hemp products, and claims of potency fraud in marijuana testing. These challenges highlight the complexity of ensuring public safety, product transparency, and consumer trust in this rapidly expanding and evolving industry. Operation Clean Leaf was designed to further investigate these concerns.

GENERAL MARKET VS. OLCC MARKET

There are two separately regulated markets in which hemp products may be sold to Oregon consumers. For clarity, we refer to these as the "OLCC market" and "general market" throughout this report.

The OLCC market refers to products sold by OLCC-licensed marijuana retailers. In addition to marijuana items, OLCC-licensed marijuana retailers can sell hemp items to adults age 21 and over, and to Oregon Medical Marijuana Program (OMMP) cardholders age 18 and over.

[1] Oregon Laws 2015, Chapter 1
[2] Agriculture Improvement Act of 2018 (H.R. 2)
[3] Oregon Laws 2024, Chapter 16

To be sold in the OLCC market, the hemp must be tracked in Oregon's Cannabis Tracking System (CTS) prior to being transferred to an OLCC marijuana licensee, and the finished hemp product must comply with OLCC rules for packaging, labeling, testing, and cannabinoid serving and concentration limits. Regulatory authority over the OLCC market rests primarily with OLCC.

The general market refers to hemp sold to Oregon consumers by anyone other than an OLCC-licensed marijuana retailer. This includes grocery and convenience stores, bars, restaurants, smoke shops, CBD stores, and online retailers. Some general market retailers may hold alcohol licenses issued by OLCC, but these are considered general market retailers because they are not subject to the regulations that apply to hemp products sold by an OLCC-licensed marijuana retailer. Regulatory authority over the general market is shared between OLCC and ODA.

"CANNABIS" "HEMP" OR "MARIJUANA"

"Hemp" and "marijuana" are different legal categories of the same plant, *Cannabis sativa* L (the cannabis plant). Both terms can also refer to products made from the cannabis plant. Under federal law in the United States, hemp and marijuana are distinguished based on the concentration of one of the active ingredients, delta-9-THC.[4] If the concentration exceeds 0.3%, it is marijuana; otherwise it is hemp.[5] Federal law also requires that legal hemp crops pass "pre-harvest" testing for "total THC."[6] Total THC includes delta-9-THC in addition to another active ingredient, THCA,[7] which can convert into delta-9-THC when heated. Federal law does not require that a commodity or product be manufactured from a legal hemp crop in order to be considered "hemp." As long as the product is made from cannabis and contains no more than 0.3% delta-9-THC, it is considered "hemp" under federal law.[8]

In Oregon, hemp and marijuana are differentiated based on provenance. Cannabis grown under a marijuana license or registration is marijuana. Cannabis grown under a hemp license that passes pre-harvest testing is hemp. Commodities and products made from marijuana plants remain marijuana, regardless of delta-9-THC concentration. Likewise, commodities and products made from hemp remain hemp, regardless of the concentration of delta-9-THC. Higher-THC hemp products are subject to additional regulation, and exporting high-THC hemp products is still prohibited even if those products are "hemp" under Oregon law.

Throughout this report, we use the term "cannabis" when referring to the plant generally, including both hemp and marijuana. We use the terms "hemp" or "marijuana" when referring to a specific subcategory of cannabis. In general, we defer to the category assigned by manufacturers and retailers when referring to cannabis and cannabis products, though the results of testing by the CRL may show that an item has been miscategorized.

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[4] Delta-9-tetrahydrocannabinol, CAS # 1972-08-3
[5] 7 USC 1639o(1)
[6] Total THC is calculated as: [Total delta-9-THC] = [delta-9-THC] + (0.877 × [delta-9-THCA]). Total delta-9-THC for useable marijuana is calculated on a dry weight basis: $P_{\text{total delta-9-THC (dry)}} = P_{\text{total delta-9-THC (wet)}} \div [1-(P_{\text{moisture}}/100)]$
[7] Delta-9-tetrahydrocannabinolic acid, CAS # 23978-85-0
[8] There is some ambiguity about the exact meaning of delta-9-THC in this context; see footnote 26, page 20.

ARTIFICIALLY DERIVED CANNABINOIDS

The hemp-derived THC market has risen dramatically in the last several years. The Brightfield Group estimates the market size to be 2.8 billion dollars as of 2023 (Brightfield Group, 2023), driven by the growth of delta-8-THC[9] and "THCA hemp" products.

One of the steps that Oregon has taken to regulate cannabis generally, and especially intoxicating hemp products, was to define the term "artificially derived cannabinoid"[10] (ADC) and place limitations on their use in products sold to Oregon consumers. Oregon law uses the term artificially derived cannabinoid to refer to "semisynthetic" cannabinoids: cannabinoids made synthetically using a starting material derived from cannabis. For example, some businesses take CBD extracted from hemp and synthetically convert it into delta-9-THC, delta-8-THC, or CBN[11].

These products have become especially popular in states without a legal adult use marijuana market. They provide an economical way to create intoxicating cannabis products that arguably fit within the definition of hemp in the 2018 Farm Bill. Some states have prohibited or attempted to prohibit ADCs, but in the states that do not prohibit their sale there are typically no age restrictions to prohibit the sale of intoxicating ADCs to minors.

WHAT DO "POTENCY," "PSYCHOACTIVE," AND "INTOXICATING" MEAN?

Cannabinoid concentration refers to the amounts of specific cannabinoids, such as delta-9-THC or CBD, present in a cannabis product. Cannabinoid concentration is colloquially referred to within the cannabis industry as "potency."

Delta-9-THC is the primary psychoactive cannabinoid responsible for the "high" or intoxicating effects commonly associated with cannabis use. The term "intoxication" describes the physical and mental changes caused by consuming substances like THC or alcohol that impair cognitive or motor functions. However, not all cannabinoids are intoxicating; for example, CBD is generally considered non-intoxicating and does not produce such effects. Having accurate cannabinoid concentration information is essential for consumers to ensure safe use and appropriate dosing.

The term "psychoactive" refers to any substance that affects the brain and alters mood, perception, cognition, or behavior. This is a very broad term that includes substances like caffeine, melatonin, delta-9-THC, and CBD. CBD is psychoactive, but not intoxicating. Delta-9-THC can be psychoactive and intoxicating. As with all potential intoxicants, the concentration and total amount consumed will affect the level of intoxication.

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[9] Delta-8-tetrahydrocannabinol, CAS # 5957-75-5

[10] OAR 845-025-1015(3): (a) "Artificially derived cannabinoid" means a chemical substance that is created by a chemical reaction that changes the molecular structure of any chemical substance derived from the plant Cannabis family Cannabaceae. (b) "Artificially derived cannabinoid" does not include: (A) A naturally occurring chemical substance that is separated from the plant Cannabis family Cannabaceae by a chemical or mechanical extraction process; (B) Cannabinoids that are produced by decarboxylation from a naturally occurring cannabinoid acid without the use of a chemical catalyst; or (C) Any other chemical substance identified by the Commission, in consultation with the authority and the department, by rule.

[11] Cannabinol, CAS # 521-35-7

Many ADCs such as delta-8-THC or HHC[12] that have become commercially popular are generally considered to be intoxicating. However, due to the novel and legally complex status of ADCs, there has been comparatively little research performed on this topic.

OPERATION CLEAN LEAF

OLCC undertook this operation to study several separate, interlocking elements of Oregon's cannabis ecosystem to better-inform data-driven regulation. OLCC teamed with ODA's Cannabis Reference Laboratory to investigate three major regulatory areas of concern:

- Pesticide contamination within the OLCC market compared to hemp products sold to consumers in the general market.
- Packaging and labeling currently being used for hemp products in the general market compared to products in the OLCC market.
- Cannabinoid concentration claims from product manufacturers, distributors, and retailers compared with the results of testing conducted by Oregon's CRL.

Data collected in these key areas helps to inform public health and regulatory enforcement priorities for cannabis products being sold in Oregon.

SAMPLE SELECTION AND COLLECTION

CANNABIS FLOWER SAMPLES

A total of 101 samples of cannabis flower were purchased for this investigation, consisting of 50 samples of marijuana flower and 51 samples of hemp flower.

The 50 marijuana samples were collected from 49 unique OLCC-licensed producer licenses across Oregon, capturing geographic diversity, strain variety, and differences in growing practices among the samples.

The hemp flower samples were collected from in-person retail sales within Oregon as well as orders made from many different online vendors. Each flower sample was submitted to the CRL to be tested for cannabinoid concentration and residual pesticides as detailed further in the report.

HEMP EDIBLE SAMPLES

A total of 50 samples of edible products purported to be hemp were purchased from 36 different locations across 10 states. Of these, 19 samples were purchased in person in Oregon from 16 different locations. Samples for this survey were selected based on the goal of capturing a diverse range of products within practical constraints. Our aims when selecting samples were to purchase them from a variety of online and in person sources with a broad geographic distribution. OLCC intentionally sought some samples which

[12] Hexahydrocannabinol CAS # 6692-85-9 (occurs in two isomeric forms, 9*S* and 9*R*, both of which have significant binding affinity at the CB_1 receptor)

appeared to contain ADCs because there are specific concerns regarding how those products are manufactured, packaged, and labeled.

PESTICIDES

For as long as cannabis products have been legally sold to consumers, pesticides have been a regulatory concern.

In 2014, before cannabis testing was required in Oregon under nascent OLCC and Oregon Health Authority (OHA) regulations, a study conducted by an independent cannabis testing laboratory revealed "extraordinarily widespread" pesticide use within the medical cannabis market (Voelker R, 2014). Similarly, in 2015, investigative reporting from the Oregonian raised concerns about pesticide use in Oregon's medical marijuana market (Crombie, 2015).

Currently, the application of any pesticide to cannabis that is not specifically exempted in Federal code 40 CFR 180 – subpart D is a violation of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). According to this rule there are more than 1,000 pesticides that could potentially be applied on cannabis that would be a violation of FIFRA. ODA maintains a guide list of pesticides that are not prohibited for use on cannabis.

Testing requirements for cannabis in Oregon are set by OHA, including setting action levels for required pesticide testing.[13] When establishing the marijuana program in Oregon, the state adopted a strategy of relying upon private laboratories to perform a screen for pesticides that were likely to be applied to cannabis, with a focus on pesticides that would also be a violation of FIFRA. All harvested marijuana within the OLCC-regulated system in Oregon is separated into batches and tested for pesticides by an independent third-party laboratory. Laboratories are licensed by OLCC and accredited by the Oregon Environmental Laboratory Accreditation Program (ORELAP) to perform this testing. The test results are reported directly to OLCC as well as to the licensee who ordered the test.

To facilitate the roll-out of this strategy, the state produced a list of 59 compounds that all cannabis sold within Oregon had to be tested for (Farrer, 2015). Most of the 59 pesticides on the list are prohibited for application on cannabis. Others (e.g. pyrethrins, piperonyl butoxide) are the active ingredient in some products on the guide list but cannot be present above the action level established by OHA. Many other states adopted similar strategies and some even adopted the same list of 59 compounds that Oregon implemented.

Pesticide presence on a crop can result from either intentional application or unintentional exposure. Intentional use occurs when pesticides are applied directly to control pests or enhance the yield of a crop; this can result in a violation of regulatory limits if performed in a non-compliant manner. Unintentional exposure can happen through environmental factors such as drift or overspray from the application of pesticides in nearby areas, cross-contamination during processing or storage, or even contaminated soil or water. Cannabis has been found to be an effective bioaccumulator, removing toxic contamination from soil (Rheay, Omondi, & Brewer, 2021). Both scenarios underscore the importance of rigorous testing and adherence to regulatory guidelines to ensure consumer safety.

[13] OAR 333-007-0400

OLCC, OHA, and ODA have been working in collaboration to address this ongoing concern. Using data from CTS, OLCC observed a rapid decline in reported pesticide testing failures following the establishment of the adult use market, leveling off to a relatively stable failure rate for the past six years.

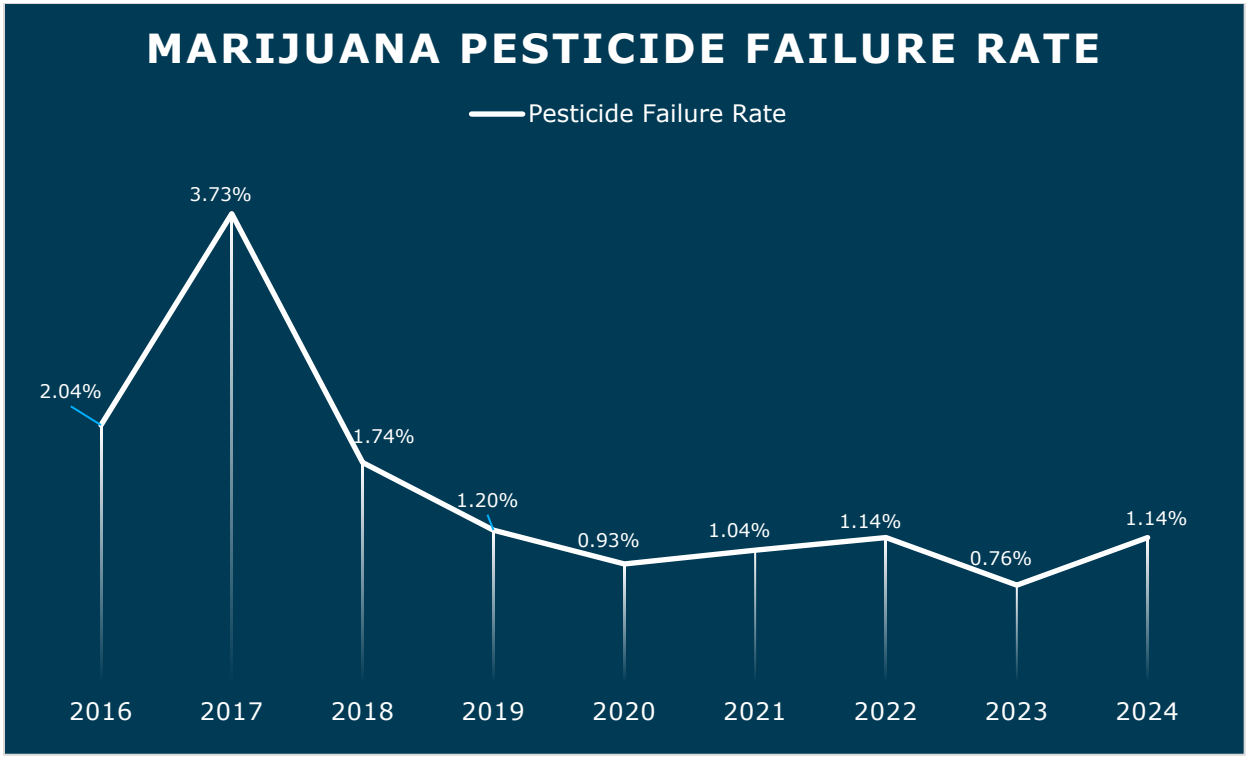


Figure 1. Pesticide failure rate over time within the OLCC market

One possible regulatory concern with this data trend is that OLCC-regulated marijuana producers are aware of which pesticides will be tested for when ordering compliance testing on their harvest lots. It is unclear if pesticide use has actually decreased or if licensees have just changed their practices and might be applying pesticides with active ingredients that are not on the required testing panel.

Other cannabis markets have observed ongoing concerns of unlawful pesticide use outside of their regulated systems. Researchers in Canada conducted a large panel pesticide screen of products in the regulated system compared to illicit cannabis products seized in Canada (Gagnon, et al., 2023). They discovered that 6% of products from Canada's regulated system had pesticide residue at the method's lowest calibration level. The illicit cannabis samples "showed a striking contrast with a 92% sample positivity rate covering 23 unique pesticide active ingredients with 3.7 different pesticides identified on average per sample."

Separately, an investigative report by the LA Times discovered many incidents of pesticide contamination in products purchased at marijuana retail stores in California (Fonseca, 2024). Alongside that investigation, the LA Times also reported that California regulatory agencies had discovered unlawful pesticides at illicit grows that appear to have been smuggled into the country from China (St. John, 2024).

PESTICIDE TESTING METHODOLOGY

The pesticide testing protocol involved two types of testing. The first screen is for a targeted list of pesticides that were chosen from three sources:[14]

- The most common pesticides in compliance test failures in the OLCC market.
- The illicit pesticides that have been discovered to be in use on cannabis in California.
- The pesticides discovered during Canada's testing of illicit cannabis.

This first type of pesticide testing included confirmation and quantitation using external reference standards. This means we verified the presence of specific pesticides in a sample and measured how much of each pesticide was in it. This is done by comparing the test results to know reference materials that contain exact amounts of those pesticides. These reference standards help to ensure the test is accurate and reliable.

The second type of pesticide testing was broader and was designed to help determine which pesticides are being used on cannabis beyond the targeted list. This screen takes advantage of relatively recent technological advancements in mass spectrometry that allow the use of pre-built transition libraries to screen for hundreds of compounds at a time. Quantitation is not directly available in this large screen. However, based on the findings of this study, future work can be performed to confirm and quantify putative pesticide detections.

PRELIMINARY PESTICIDE TESTING RESULTS

Due to the complexity of this testing, the data at this time is not complete. However, initial results from the targeted analyte list resulted in two pesticide detections. One sample from the OLCC market was discovered to have a concentration 3.8 parts per million (ppm) of imidacloprid, which far exceeds the established action level of 0.4 ppm. OLCC, in coordination with ODA, immediately launched a recall of the product, removing it from commerce (Oregon Liquor and Cannabis Commission, 2024). Additionally, a hemp sample had a trace detection of spirodiclofen at 2 parts per billion (ppb).

From the broader screen, there are approximately 50 putative detections that are awaiting confirmation and quantification once reference standards are obtained.

Although the current study has not been completed, the detection of spirodiclofen, which is not included in the current list of 59 compounds, provides support for performing a more comprehensive screen to provide important information that can be used to reevaluate the current strategies that have been implemented to curtail misapplication of pesticides on cannabis sold in Oregon.

EDIBLE PACKAGING AND LABELING

Generally speaking, hemp products for sale to consumers in Oregon outside of the OLCC market are not required to be packaged or labeled in a specific manner.[15] Within the OLCC

[14] The full list is contained in Appendix A:Targeted Analytes for Pesticide Screen.
[15] "Industrial hemp-derived vapor items" are an exception (ORS 475C.600 to 475C.684; OAR 845-026-7000 to -7070), but no industrial hemp-derived vapor items were examined in this study.

market, all cannabis products that are sold to consumers, including hemp products, must meet certain packaging, labeling, and testing requirements. As part of this survey, OLCC purchased 50 products purported to be hemp derived from the general market. OLCC staff reviewed the packaging and labeling of these products in comparison with the established standards for regulated marijuana products and hemp products sold in the OLCC market. This was done via physical inspection of each product's packaging and labeling and submitting all samples for potency testing[16] conducted by the CRL. A standardized rubric was created to evaluate the hemp products across several criteria: child resistant packaging, labeling or product form that appeals to minors, clear information about dosage and serving size, accurate potency claims on the label, health warnings, and adherence to specific labeling requirements.

Edible Package Review Methodology

OLCC staff consisting of the Hemp & Cannabinoid Compliance Coordinator, Packaging and Labeling Specialist, Laboratory Compliance Coordinator, and Hemp and Laboratory Regulatory Specialist – with over thirty years of combined experience in cannabis product regulation – evaluated the samples using a pre-built rubric and reviewed the following categories:

- **Child Resistance:** Cannabis products in the OLCC market are required to submit documentation that the package has been certified as child resistant as defined by 16 CFR 1700 by a qualified third-party child-resistant package testing firm. If the package does not meet these standards, the label must have the warning "This package is not child resistant." OLCC staff have familiarity with products that are sold in child resistant packaging, however, it should be noted that OLCC staff are not experts in this area and relied on physical inspection and experience.
- **Appealing to Minors:** OLCC evaluated the label and product separately for their attractiveness to minors as defined in OLCC's administrative rules.[17] Examples include cartoons (as defined in OLCC rules), images of minors, and designs or brands of non-cannabis products that are marketed to minors. Products were also evaluated under OLCC rules as to whether they would be attractive to minors, primarily as to whether they resembled a non-cannabis consumer product primarily consumed by and marketed to children.[18]

Figure 2. An observed example of gummy rings

[16] Testing for delta-9-THC, delta-9-THCA, delta-8-THC, CBD (cannabidiol), and CBDA (cannabidiolic acid)
[17] OAR 845-025-1015(5) and (17)
[18] OAR 845-025-3220

- **Clear Potency:** OLCC evaluated whether the label made a claim about its cannabinoid concentration such that layperson could reasonably understand what they were consuming. Products that used the Greek letter delta (δ or Δ) to identify the active ingredient were not considered to be sufficiently clear.

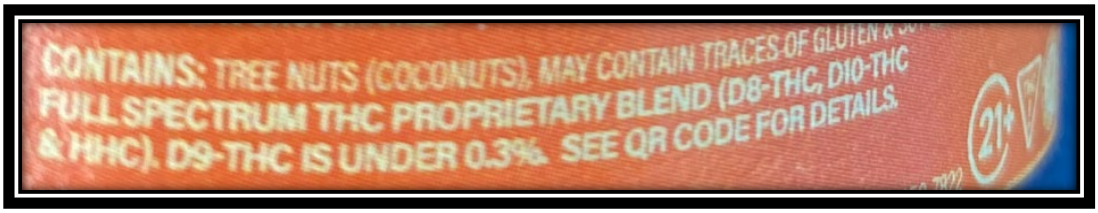


Figure 3. An example of a product with an unclear potency claim.

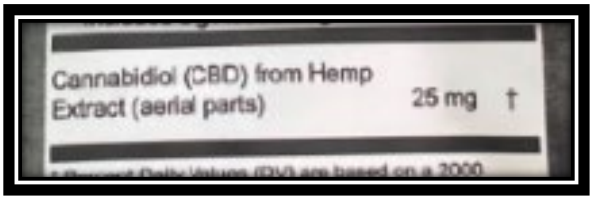


Figure 4. An example of a clear potency claim

- **Identified Serving Size:** This category was used to indicate whether the label contained language that clearly described what quantity or portion of the product was intended to be consumed as a single serving.

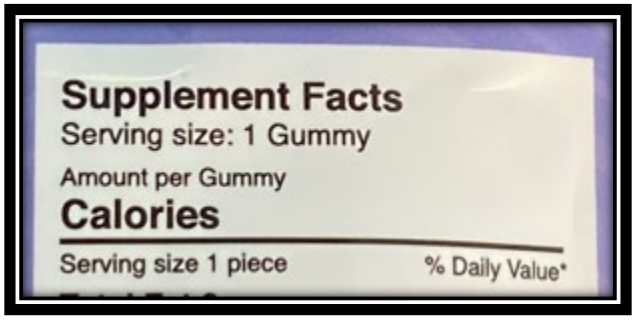


Figure 5. An example of a clearly identified serving size

- **ID Verification at Sale:** This category was used to indicate whether ID verification was required to purchase the sample.[19] Online websites requiring you to push a button claiming you are over 18 or 21 were not considered age verification. If the online retailer required sending a photo of a valid ID or used a third-party service to verify a valid ID, this was considered an age verification process.

- **Health Claims:** Means the presence of any claim made on the label that expressly states or implies a relationship between a substance and a disease or health-related condition.

[19] OAR 845-025-2820 - Retailer Operational Requirements (contains list of valid ID for purchase of marijuana in Oregon)

- **Ingredient Listing Type (Food vs Dietary Supplement):** We noted which labels appeared to list ingredients with a traditional food label or a dietary supplement label. This paper does not weigh in on any legal issues surrounding these templates, but added this information because it may provide more information to consumers and potentially impacts disclosure of major allergens.

Figure 6. Examples of observed supplement (left) and food (right) labels

- **Prohibited Ingredients:** When ingredients were listed, OLCC evaluated if any of the listed ingredients would be prohibited in cannabis products sold in the OLCC market. Examples of prohibited ingredients in the OLCC market include nicotine and melatonin.[20] While ADCs are prohibited for sale to Oregonians, we did not consider the presence of those in this category rather that would be captured in the "Prohibited Potency."
- **Prohibited Potency:** This category was built to track products that either contained artificially derived cannabinoids or products that exceed the potency limits established by OLCC for hemp products based on the label claims.[21]
- **Warning Statements:** For this category, OLCC did not evaluate the labels to see if their warning statements matched OLCC requirements, but looked to warnings that may alert the consumer to the potential intoxicating nature of these products. For example, "For use only by adults 21 and older" and "Do not operate heavy machinery."
- **Warning Symbol:** OLCC considered any generally recognized warning symbol used by a U.S. jurisdiction that is intended to warn the consumer the product contained cannabis.

[20] OAR 845-025-1015(1) and 845-025-3220(3)
[21] OAR 845-026-0400 and OAR 845-026-0410 for sales to adults in the general market

Figure 7. Examples of observed warning symbols

We did not consider "21+" in and of itself to be considered a sufficient "warning symbol."

EDIBLES WITH PROHIBITED POTENCY

Of the samples purchased, 72% had prohibited potency based on the labeled potency or information linked to the samples on the websites from which the products were ordered. We are still awaiting results from the CRL to determine which samples actually contained prohibited quantities or concentrations of THC or ADCs.

CHILD RESISTANCE

54% of products (27 of 50) had some form of child-resistant packaging. Of products with potency levels that are prohibited for sale in Oregon, 27% (8 of 30) lacked child-resistant packaging. There was a correlation between child-resistant packaging and higher-potency products (33% of lower potency products vs 73% of prohibited potency products).

Oregon researchers revealed that rates of child poisonings substantially increased after the allowable potency limits for marijuana edibles was doubled in 2022 (Dilley, Hendrickson, Everson, & Jeanne, 2024). This underscores the need for safe packaging of intoxicating products as a means of promoting public health and safety.

DIFFICULT FOR CONSUMERS TO KNOW DOSAGE, SERVING SIZE

It is important for consumers to be able to readily identify what substances are present in a product and in what quantity. Labels on the hemp edibles in our sample frequently obscure this information. Common issues include:

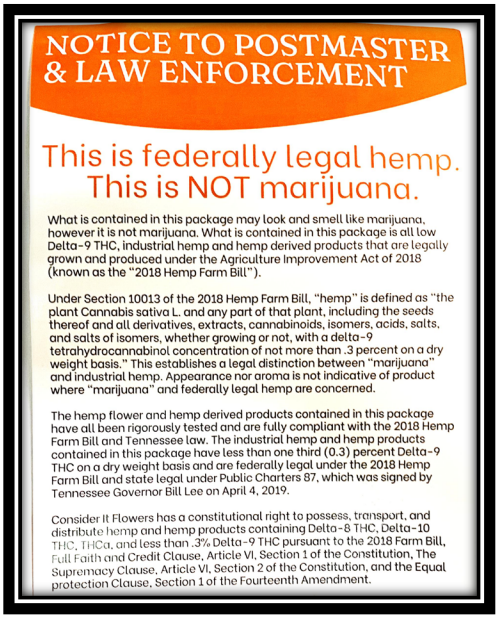
- Advertising the dose without specifying whether this is the dose per serving or the total amount present in the entire container.
- Only specifying the amount of "full spectrum hemp extract" or "broad spectrum hemp extract" without specifying how much of any particular cannabinoid is present.
- Multiple different serving sizes listed on the same product. For example, the nutrition panel says the serving size is "1 gummy" but elsewhere the directions say to "start with half."
- Use of the Greek capital letter delta (Δ). While the product manufacturers are familiar with this symbol, it may not be recognizable to the average consumer.

LACK OF CLEAR POTENCY TESTING INFORMATION

Most websites and many labels claim the product is tested by a third-party laboratory, but finding the results of these alleged tests often proved difficult to impossible. While many products include a quick-response (QR) code on the label that purports to link to test results, very few of these QR codes actually function as a consumer would expect. Many are broken links. When a link works, it typically takes the consumer to a website with dozens of test results for a wide variety of products, or to the manufacturer's home page, rather than to the specific certificate of analysis (COA)[22] for the product in hand. Many web sites have a long list of COAs available, but the product name on the website often does not match the product description on the COA, leaving consumers guessing about whether the product they purchased is listed on the test results page at all.

Additionally, 62% of products (31 of 50) do not provide a lot number or batch number on the label. Without a lot or batch number, a consumer cannot be certain whether the test results they are looking at – if they are able to locate any results – correspond to the lot or batch of the product they purchased. Even when a lot or batch number is present on the product, the test results do not necessarily contain the lot or batch number. Some manufacturers only have one set of test results for a product, which could indicate that they only tested a single lot or batch and do not routinely test subsequent lots or batches.

Occasionally an online retailer would include a COA with the product they shipped. On several occasions this COA was for hemp flower (presumably the flower used to manufacture the product) rather than for the product itself. Most products were shipped with some kind of statement to the shipper (USPS, FedEx, UPS) that the item was compliant with the 2018 Farm Bill and was legal to ship to all states.


NOTICE TO POSTMASTER & LAW ENFORCEMENT

This is federally legal hemp.
This is NOT marijuana.

What is contained in this package may look and smell like marijuana, however it is not marijuana. What is contained in this package is all low Delta-9 THC, industrial hemp and hemp derived products that are legally grown and produced under the Agriculture Improvement Act of 2018 (known as the "2018 Hemp Farm Bill").

Under Section 10013 of the 2018 Hemp Farm Bill, "hemp" is defined as "the plant Cannabis sativa L. and any part of that plant, including the seeds thereof and all derivatives, extracts, cannabinoids, isomers, acids, salts, and salts of isomers, whether growing or not, with a delta-9 tetrahydrocannabinol concentration of not more than .3 percent on a dry weight basis." This establishes a legal distinction between "marijuana" and industrial hemp. Appearance nor aroma is not indicative of product where "marijuana" and federally legal hemp are concerned.

The hemp flower and hemp derived products contained in this package have all been rigorously tested and are fully compliant with the 2018 Hemp Farm Bill and Tennessee law. The industrial hemp and hemp products contained in this package have less than one third (0.3) percent Delta-9 THC on a dry weight basis and are federally legal under the 2018 Hemp Farm Bill and state legal under Public Charters 87, which was signed by Tennessee Governor Bill Lee on April 4, 2019.

Consider It Flowers has a constitutional right to possess, transport, and distribute hemp and hemp products containing Delta-8 THC, Delta-10 THC, THCa, and less than .3% Delta-9 THC pursuant to the 2018 Farm Bill, Full Faith and Credit Clause, Article VI, Section 1 of the Constitution, The Supremacy Clause, Article VI, Section 2 of the Constitution, and the Equal protection Clause, Section 1 of the Fourteenth Amendment.

Figure 8. An example of a notice to mail carriers regarding the legality of the product

[22] In this report, the term "COA" is used specifically to refer to a report containing laboratory results from third party laboratory testing; we do not use it to refer to test results reported by the CRL.

DISCREPANCY BETWEEN LABEL CLAIMS AND PRODUCT COAS

Only 10% (5 of 50) of the edible packages had clear potencies listed on the label and a clear link to the product's COA. Among products where a corresponding COA was able to be located, the results on the COA often differed from the label claim by a significant amount:

- **Example 1:** The label claims the product contains 10 mg delta-9-THC each and 15 mg CBD each. The label shows each serving is 4 grams. The COA sent with the product shows each serving is 4.5 grams and contains 8.735 mg/serving of delta-9-THC and 0.405 mg CBD/serving.
- **Example 2:** The label claims the product contains 10 mg delta-9-THC per serving. The label also shows each serving is 4 grams. The COA provided with the product states the items contain 2.98 mg/g of delta-9-THC. At 2.98 mg/g, a 4 gram serving contains 11.92 mg/serving of delta-9-THC, which is nearly 20% more than the label claim.

Having a THC potency higher than the consumer expects could result in greater levels of intoxication especially in novice users and users with lower tolerance.

LACK OF CONSISTENCY IN PRODUCT CATEGORIES

Conventional foods and dietary supplements are subject to different labeling requirements when regulated by the U.S. Food and Drug Administration (FDA) in interstate commerce. While the ODA Food Safety program is prohibited from considering hemp to be an adulterant in foods,[23] the FDA has clearly stated that CBD and THC are prohibited in both conventional foods and dietary supplements in interstate commerce.

Of the products reviewed, 56% (28 of 50) were labeled as conventional foods and 20% (10 of 50) were labeled as dietary supplements. The remaining 24% (12 of 50) were not clearly labeled as either conventional foods or dietary supplements.

CANNABINOID CONCENTRATION

The accuracy of labels on cannabis products is a national concern. OLCC has received many complaints, formally and informally, regarding concerns of products misrepresenting their cannabinoid concentration. A typical consumer likely equates higher THC results on a product's label with it being of higher quality or having a stronger intoxicating effect. However, intoxication from cannabis use is a complex phenomenon that is still being studied. There are many other chemicals present in cannabis flower which may also contribute to or mitigate the effects of THC. For example, CBD is not intoxicating by itself, but large amounts of CBD have been observed to increase intoxication from THC when consumed orally (Klein, et al., 2011). This is a subject that needs further study, but consumer perception has had a powerful effect on the industry in terms of price setting and marketing.

[23] In this context, "food" encompasses both conventional foods and dietary supplements.

The consumer research company CBD Oracle has authored several reports highlighting ongoing issues with inaccurate and misleading cannabis product labeling. In 2021, CBD Oracle purchased 51 "hemp" products advertised as containing delta-8-THC and had these products tested by an independent cannabis testing laboratory. They discovered 76% of these items contained greater than the federal limit of 0.3% delta-9-THC for a hemp item (Johnson, 2021). In 2022, CBD Oracle tested 53 "hemp" products which advertised that they contained delta-9-THC and found that only 49% of the products were within 15% of the labeled potency (Johnson, 2022).

Colorado researchers in 2023 tested 23 samples of cannabis flower and found that approximately 70% of the samples had a total THC concentration more than 15% lower than the concentration advertised on the label (Schwabe, Johnson, Harrelson, & McGlaughlin, 2023).

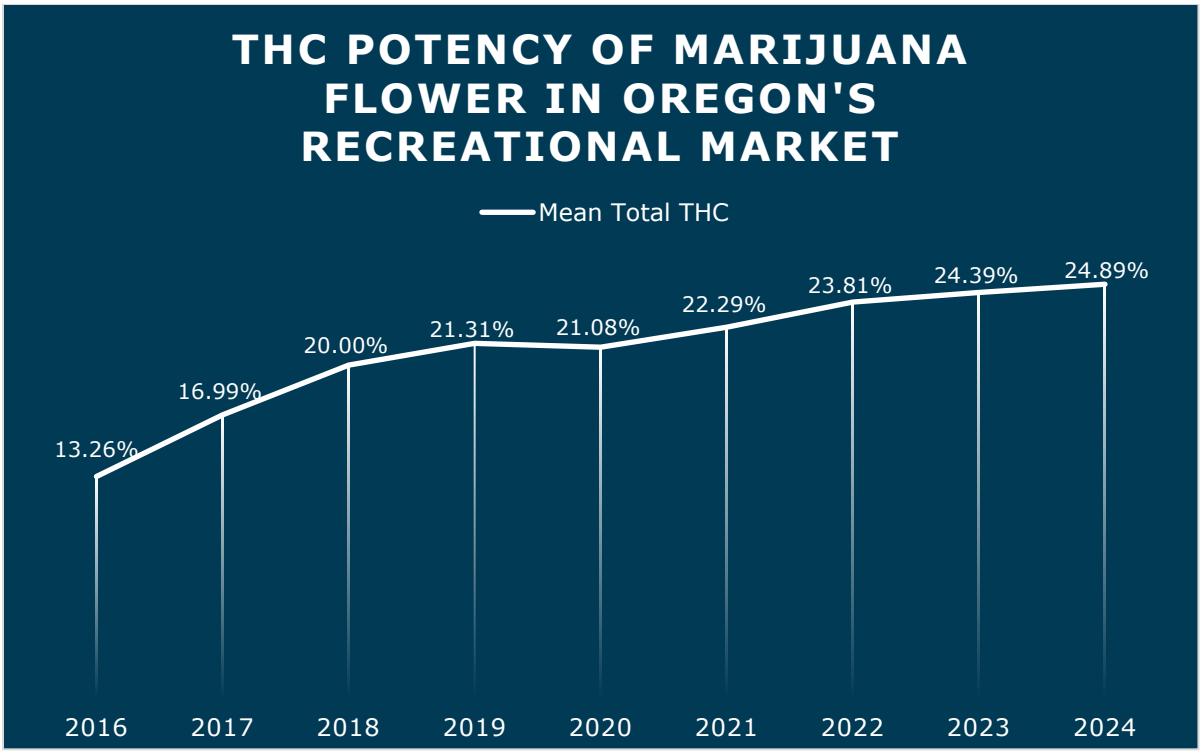


Figure 9. Mean total THC in flower categorized as "Buds" within CTS

In Oregon, the data collected from CTS shows there has been a steady increase in the average total THC concentration in marijuana flower categorized as "Bud" [24] over the past eight years.

This could be an indication of THC inflation[25] by licensees. This is an issue which has been widely reported to OLCC by marijuana licensees. Licensees face market pressure to report

[24] This is the category name used in Metrc to describe the most valuable part of harvested cannabis. "Bud" is trimmed cannabis flower which is sold to consumers and is usually intended for use by inhalation.
[25] A practice where the total THC concentration reported by laboratories overstates actual concentration of total THC in the batch. This can be a result of actions by the laboratory or their staff, the licensee who requested testing or their staff, or some combination of actions by both parties.

higher THC results in flower due to consumer preferences and financial incentives. Flower with higher reported THC potency tends to command premium prices (see The Power of Price on Potency, page 29). This can create pressure to intentionally manipulate the test results, including by manipulating the samples before they are tested. Over time, this trend can artificially elevate the reported average THC potency across the state, creating a feedback loop where licensees race to meet the new higher baseline THC potency to remain competitive. Another explanation for this increase would be that growers actively select for marijuana strains which provide higher results. Both forces are likely at play.

CANNABINOID CONCENTRATION TESTING METHODOLOGY

Cured cannabis and hemp flowers were frozen with liquid nitrogen and processed to a fine powder using a mortar and pestle. Residual moisture was determined by measuring the weight of water lost upon drying at 100 °C until a constant weight was obtained. Total cannabinoids were solvent extracted from the ground flowers using methanol. Individual cannabinoids were detected using reverse-phase HPLC with diode-array detection. Quantification was performed by comparing responses against the responses of reference standards.

HEMP FLOWER

LABEL AND THIRD-PARTY LABORATORY CLAIMS

All flower in this category purported to be "hemp" when purchased, typically referencing the federal definition: 0.3% delta-9-THC or less.[26] Four samples (7.8%) actually exceeded 0.3% delta-9-THC based on label claims or third-party laboratory test results and appear unambiguously to be marijuana under federal law. Another 36 samples (70.6%) did not exceed 0.3% delta-9-THC based on label claims or third-party laboratory test results. The remaining 11 samples (21.6%) did not have any specific claims about the concentration of delta-9-THC.[27]

Oregon regulations on the sale of hemp flower to Oregon consumers in the general market limit the allowable concentration of total THC, not only delta-9-THC. Specifically, usable hemp and hemp cannabinoid product are limited to 0.3% total THC and are not permitted to contain ADCs.[28] Based on the label claims or third-party test results, the vast majority of the hemp flower samples we purchased, 78.4% (40 of 51), were prohibited for sale to an Oregon consumer: 7.8% (4 of 51) contained ADCs, and 70.6% (36 of 51) exceeded 0.3%

[26] The hemp industry typically takes the position that cannabis and products derived from cannabis are hemp as long as they do not exceed 0.3% delta-9-THC on a dry weight basis, regardless of the total THC concentration (citing to the definition in 7 USC 1639o). In contrast, the DEA has expressed their opinion that THCA "is equivalent to delta-9-THC" in this context: "Thus, for the purposes of enforcing the hemp definition, the delta-9-THC level must account for any delta-9-THCA in a substance" (Boos, Letter to Shane Pennington, 2024).
[27] For the purposes of this report, a statement on the label that the flower contains "less than 0.3% delta-9-THC" or similar language was not considered a specific claim in the absence of a COA or a specific concentration of delta-9-THC detected in the flower.
[28] OAR 845-026-0400 and 845-026-0410 limit the concentration to 0.3%, but allow a 10% buffer for hemp flower to exceed this limit.

total THC.[29] Only 21.6% of samples (11 of 51) appeared likely to be legal for sale to Oregon consumers based on the label claims and COAs.

In addition to the 11 samples (21.6%) that appear to be below Oregon's total THC threshold, 4 of the samples (7.8%) only slightly exceeded Oregon's total THC threshold for sale to consumers, purportedly containing more than 0.3% but less than 1% total THC. These products were likely not sold with the intention of producing significant intoxication. The remaining 70.6% of samples (36 of 51) are likely to be significantly intoxicating based on the concentration of total THC or the presence of ADCs.

Of the "THCA hemp" flower samples, 28 had associated label claims or test results indicating the total THC concentration.[30] These samples ranged from 17.9% to 38.6% total THC, with a mean of 24.7% total THC (standard deviation ±4.9%) and a median of 23.2% total THC.[31]

CRL RESULTS

All 51 samples of hemp flower tested by the CRL exceeded 0.3% total THC. Based on these tests results, all of this flower is prohibited for sale to Oregon consumers, ranging from 0.4% to 30.5% total THC.

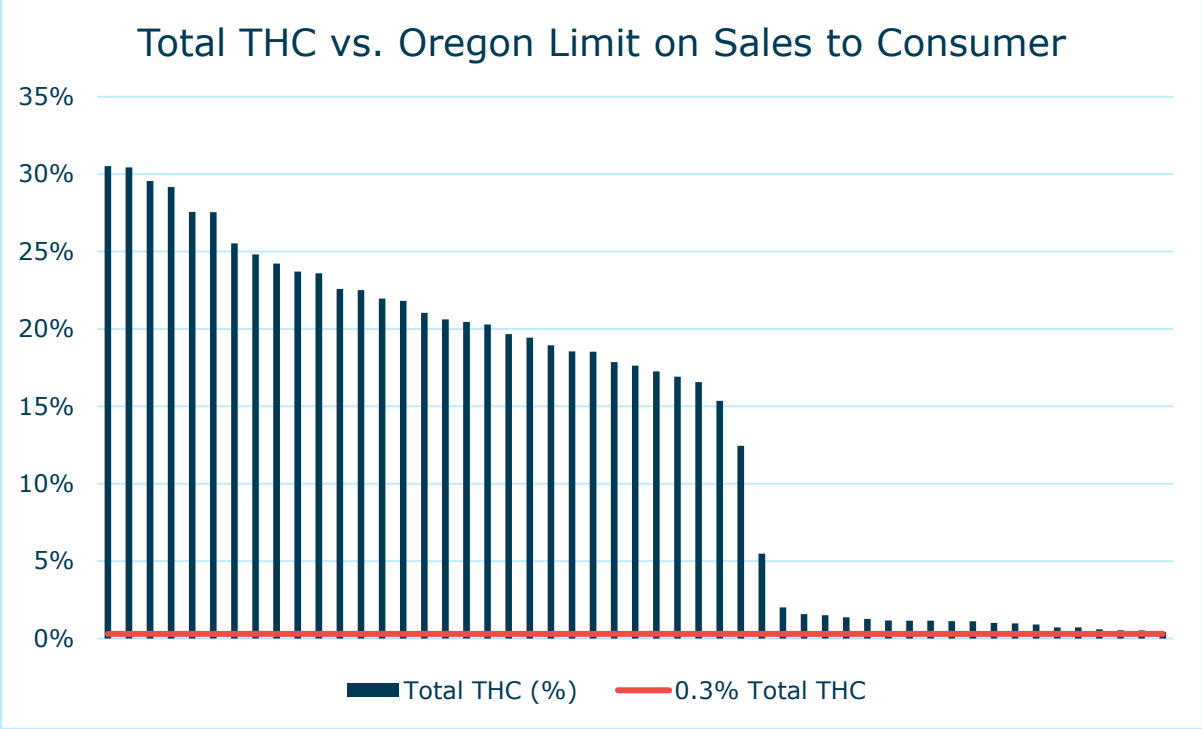


Figure 10. Total THC in "hemp" flower samples

[29] For the purposes of this evaluation, products sold or marketed as "THCA hemp" or "THCA flower" were presumed to exceed 0.3% total THC even if the exact concentration of THCA or total THC was not specified.
[30] One sample purporting to contain 5.75% total THC and 12.74% CBD was excluded from this figure. While it contains substantially more THC than genuine CBD hemp flower, it represents a cannabis phenotype that is distinct from high-THC/low-CBD cannabis.
[31] Excluding three samples that were advertised as THCA flower but did not contain specific label claims about delta-9-THC or THCA concentration and did not have associated COAs.

Additionally, the majority of hemp flower tested by the CRL, 74.5% (38 of 51), contained more than 0.3% delta-9-THC. Cannabis flower that exceeds 0.3% delta-9-THC is unambiguously considered marijuana under federal law.

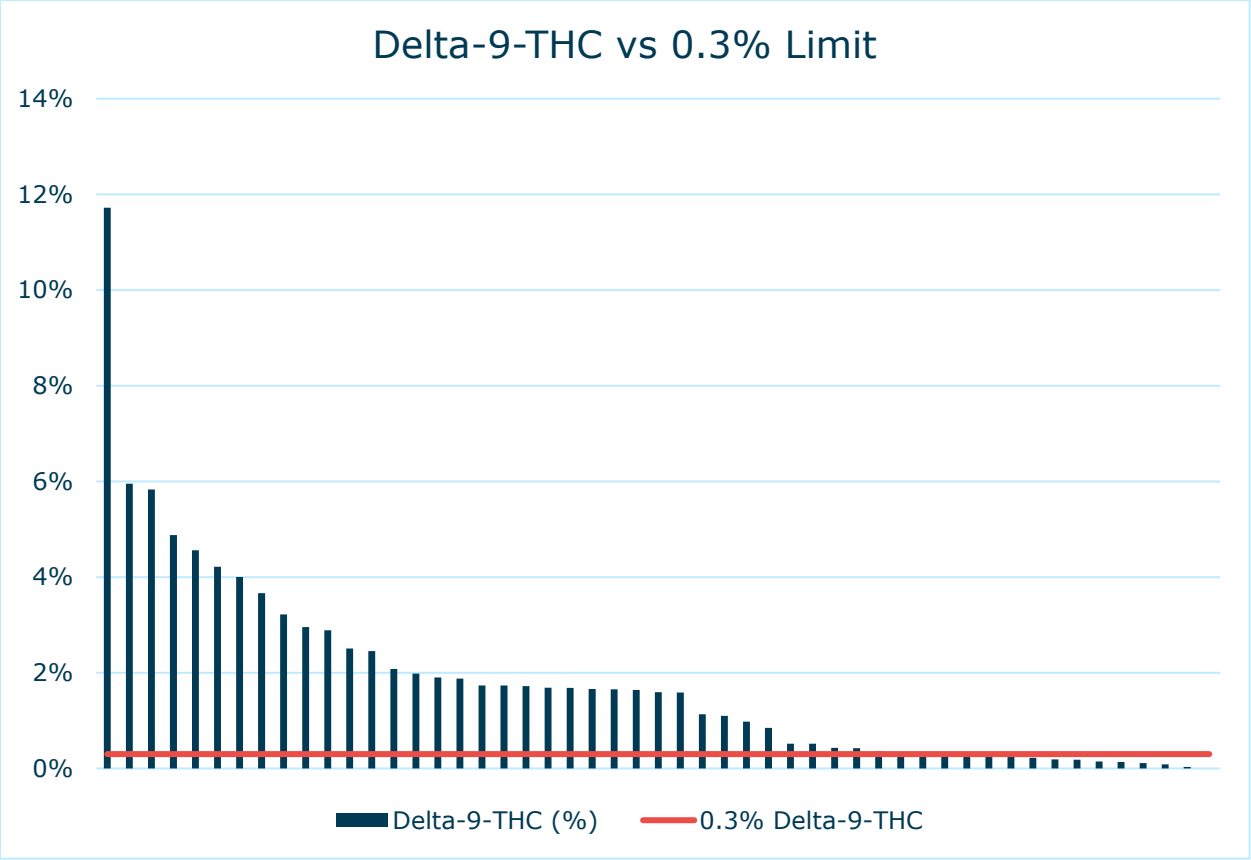


Figure 11. Delta-9-THC in "hemp" flower samples

It is worthwhile to note that cannabis flower is inherently heterogeneous. Different individual flowers ("buds") from the same harvest batch can have significantly different concentrations of delta-9-THC or total THC. It is possible that some of the hemp flower that exceeded 0.3% delta-9-THC came from a batch that legitimately tested below 0.3% as a batch-wide average based on representative sampling. The DEA has suggested that the analysis of whether a cannabis material is hemp or marijuana based on the 0.3% threshold for delta-9-THC "is conducted separately for each substance, without regard to the delta-9-tetrahydrocannabinol concentration of the substances from which it is derived" (Boos, 2022). This results in a curious situation where a batch of cannabis flower as a whole may be hemp, but when divided into smaller increments for sale, some of those smaller increments may become marijuana under federal law.

It is also possible that some of the delta-9-THCA that was originally present in the samples decarboxylated into delta-9-THC after the manufacturer or distributor tested the flower. This can happen over time (see Time and Potency, page 27), likely depending on the conditions under which the flower was stored, especially if it was stored in an environment with significant fluctuations in temperature. In this case, the batch as a whole could have been

hemp at the time it was tested, but it could have become marijuana under federal law in the interval between manufacturer/distributor testing and the time that it was sold. [32]

While these factors may be relevant when considering specific samples of hemp flower individually, the data in aggregate paints a clear picture: The majority of flower that OLCC purchased as "hemp" was in fact marijuana under federal law. Aside from the factors listed above, the following could also account for this trend include:

- Some of the flower may have been sold as less than 0.3% delta-9-THC on the basis of pre-harvest testing, without checking the delta-9-THC concentration of the finished flower. Pre-harvest testing typically happens a few weeks prior to harvest, and cannabinoid concentrations increase dramatically in these last few weeks.
- Some testing laboratories may be underreporting the delta-9-THC concentration when testing hemp flower. This could be intentional to attract and retain clients who want test results showing their flower is hemp under federal law. It could also be unintentional, where the laboratory is unaware that their test results are biased, but clients have identified the laboratory as a reliable source of test results showing low concentrations of delta-9-THC.
- When testing the flower, the manufacturer or distributor may be intentionally selecting samples that are likely to have lower concentrations of delta-9-THC than the batch as a whole. For example, they may send samples of less developed flowers with larger stems and with lower-potency fan leaves still intact.

The results from the CRL can be divided into four general categories:

Low THCA and low CBDA: This typically represents cannabis that is grown primarily for its total CBG content. Based on CRL results, 5.9% of the hemp samples (3 of 51) fit in this category. Within this category, none (0 of 3) exceeded 0.3% delta-9-THC but all (3 of 3) exceeded 0.3% total THC.

Low THCA and high CBDA: This typically represents cannabis that is grown primarily for its total CBD content. Based on CRL results, 21.6% of the hemp samples (11 of 51) fit in this category. Within this category, 55.5% of samples (5 of 11) exceeded 0.3% delta-9-THC and all (11 of 11) exceeded 0.3% total THC.

High THCA and low CBDA: This typically represents cannabis grown for its total THC content. While any consumer would perceive this type of flower as ordinary marijuana, some businesses sell it as "THCA hemp." Sellers purport that the flower is hemp under federal law as long as it does not exceed 0.3% delta-9-THC, regardless of the total THC concentration. Based on CRL results, 60.8% of the hemp samples (31 of 51) fit in this category. Within this category, all samples (31 of 31) exceeded both 0.3% delta-9-THC and 0.3% total THC.

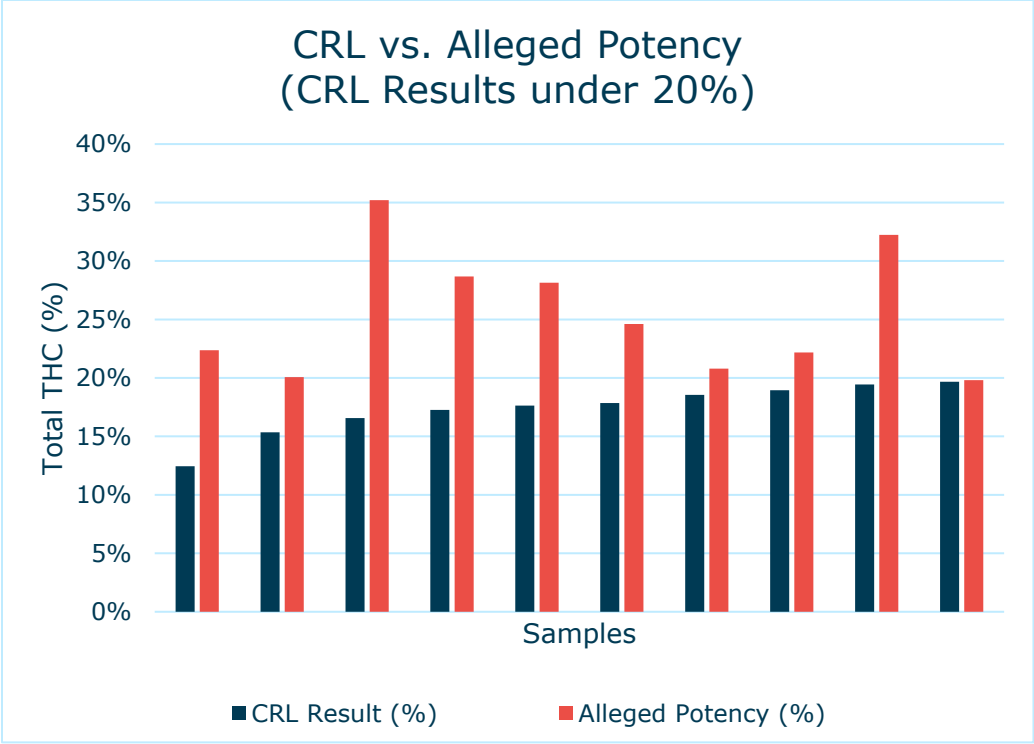
[32] Based on the theory that "hemp" is defined based exclusively on delta-9-THC concentration, without regard to THCA; see footnote 26, page 20.

Atypical: A few hemp samples, 11.8% (6 of 51) did not fit any of the ordinary categories. These atypical results divide into three distinct subcategories:

- **Artificially derived cannabinoids:** All of the hemp flower samples that were advertised to contain artificially derived cannabinoids, including flower advertised as containing HHC, THCO, or THCP, contained significant levels of delta-8-THC. Based on CRL results, 7.8% of the hemp samples (4 of 51) fit in this category. Within this category, 25% of samples (1 of 4) exceeded 0.3% delta-9-THC and all (4 of 4) exceeded 0.3% total THC. All samples in this category also contained detectable amounts of delta-4(8)-*iso*-THC. Delta-4(8)-*iso*-THC is a cannabinoid derivative that does not occur in the cannabis plant but has been reported to occur when delta-8-THC is manufactured from CBD by acid-catalyzed isomerization (Geci, Scialdone, & Tishler, 2023).
- **High CBD and low CBDA:** One sample contained very high levels of decarboxylated CBD. This sample had a relatively low level of total THC, mostly in the form of THCA. This most likely represents CBG hemp flower to which decarboxylated CBD isolate has been added. This sample did not exceed 0.3% delta-9-THC but did exceed 0.3% total THC.
- **Intermediate CBD/THC:** One sample contained moderate amounts of THCA and CBD, with approximately a 2:1 ratio of total CBD to total THC. Cannabis flower of this type is relatively uncommon within both the hemp market and the adult use marijuana market. This sample exceeded both 0.3% delta-9-THC and 0.3% total THC.

This breakdown is consistent with the different types of "hemp" flower that OLCC is familiar with being available in the market.

As shown in Figure 12 and Figure 13, there was significant deviation between the CRL results and the alleged total THC in the samples of "THCA hemp" (high THCA and low CBDA) with accompanying total THC claims suitable for comparison. On average, the alleged total THC concentration were 17% higher (median 5% higher) than the CRL results. Interestingly, the majority of the discrepancies were in samples that the CRL found to contain less than 20% total THC. In samples with CRL results below 20% total THC, the alleged results were on average 48% higher than the CRL results. In samples with CRL results above 20% total THC, the alleged results were on average 0.6% lower than the CRL results.



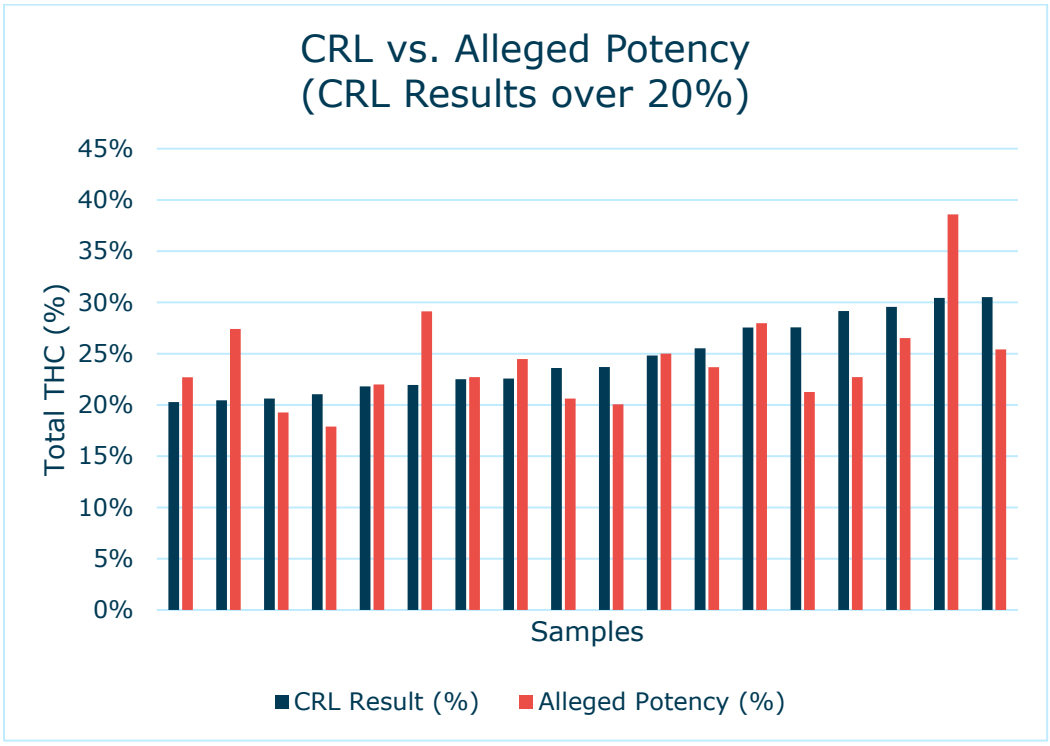


Figure 12. Total THC reported by CRL compared with alleged total THC concentration in "THCA hemp" flower samples

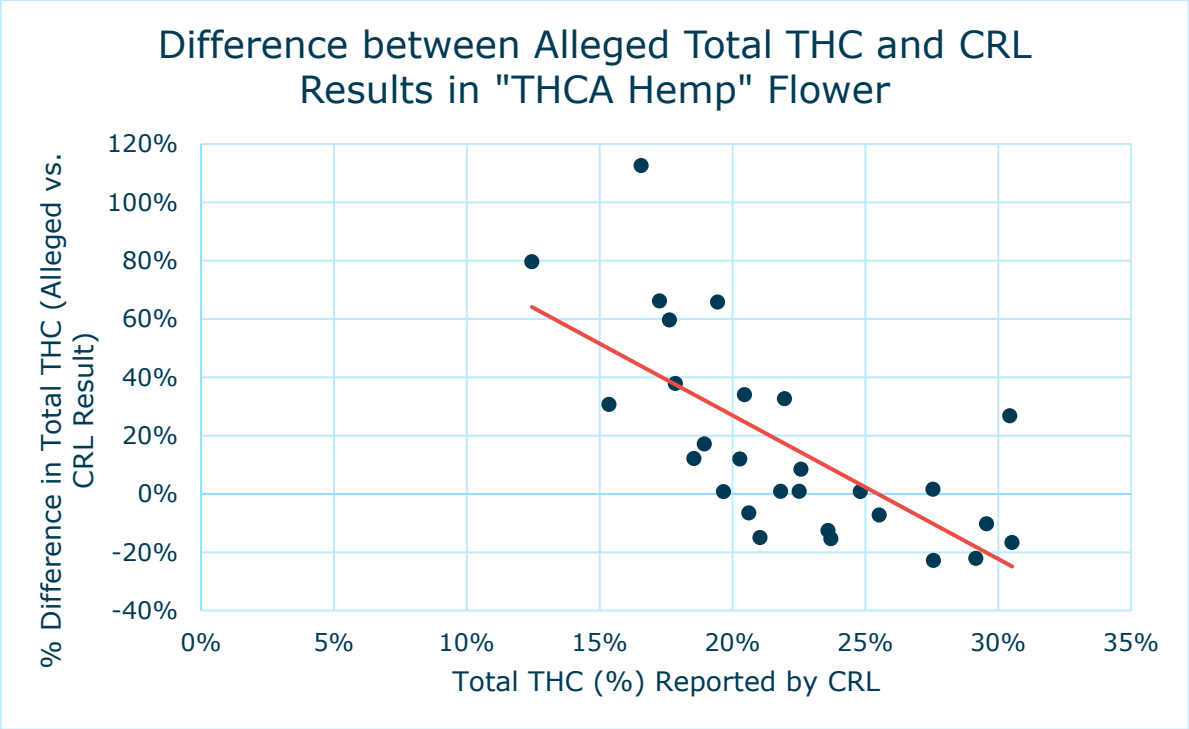


Figure 13. Difference between total THC reported by CRL compared with alleged total THC concentration in "THCA hemp" flower samples

Additional data on the market dynamics of THCA hemp may be useful in understanding these results.

MARIJUANA FLOWER

The average reported potency for the 50 marijuana samples was 24.9% total THC according to OLCC's CTS data. According to the CRL test results, the average potency for these samples was 22.5%.

CRL RESULTS

The majority (72%; 36 of 50) of results reported by OLCC-licensed third-party testing laboratories were higher than the CRL test results. On average, the third-party laboratory results were 13.0% higher relative to the CRL results with a standard deviation of ±19.4%. In absolute percentage points, the average difference and standard deviation between the CRL results and third-party results was +2.4% ±4.1% total THC.

The difference between potency reported by the CRL and potency reported by third-party laboratories has substantial financial implications for the cannabis industry (see The Power of Price on Potency, page 29). Producers and wholesalers have a strong incentive to get the highest possible result for each batch of flower, and laboratories have a strong incentive to provide higher results in order to attract and retain clients.

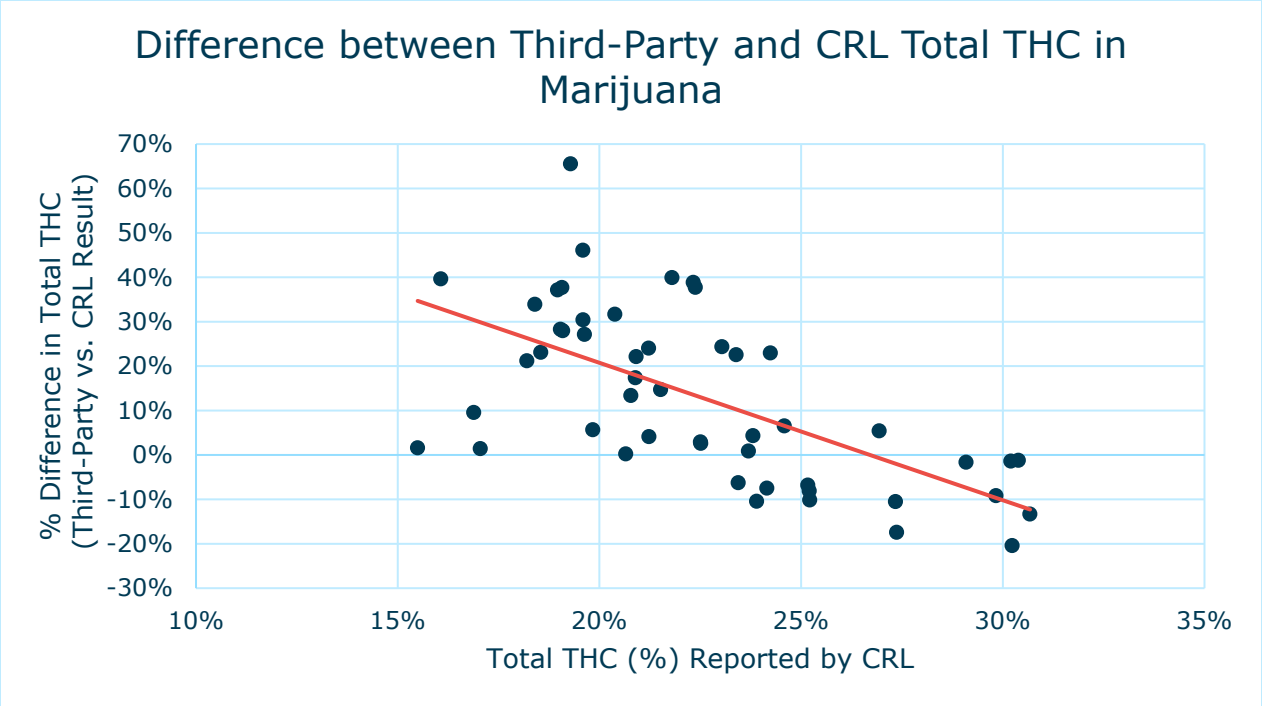


Figure 14. Difference between total THC reported by CRL compared with third-party laboratory results in marijuana flower samples

In 2024, OLCC issued administrative notices to several licensees and employees of licensees, including laboratory licensees, alleging improper sampling or adulterating of samples prior to testing. This alleged violative sampling is only one of many possible methods by which a testing laboratory could produce results that skew higher than the actual average potency of the batch. Other forms of THC manipulation may also be occurring and are generally difficult to detect.

TIME AND POTENCY

There are also potentially more innocuous reasons why the CRL results may be lower than the results of third-party laboratories. The total THC concentration in cannabis flower may degrade over time during storage, depending on storage conditions. This phenomenon has not been well studied, and it is not possible at present to estimate the effect of time and storage on cannabinoid concentration over time. Zamengo, et al. (2019) found that THC degraded significantly over time in flower and concentrates, while Davkova, et al. (2023) reported that storing flower at 104° F and 75% relative humidity for 3 months actually increased the total THC concentration in the samples while resulting in significant decarboxylation of THCA to delta-9-THC.

To evaluate the influence of decarboxylation and degradation of THC over time in this data, we noted the amount of time that had elapsed between the initial third-party testing and the testing performed by the CRL result. First, we compared the change in the proportion of

decarboxylated THC[33] between the third-party laboratory results and CRL results, plotted as a function of the time elapsed between the tests, to evaluate decarboxylation of THCA to delta-9-THC over time.

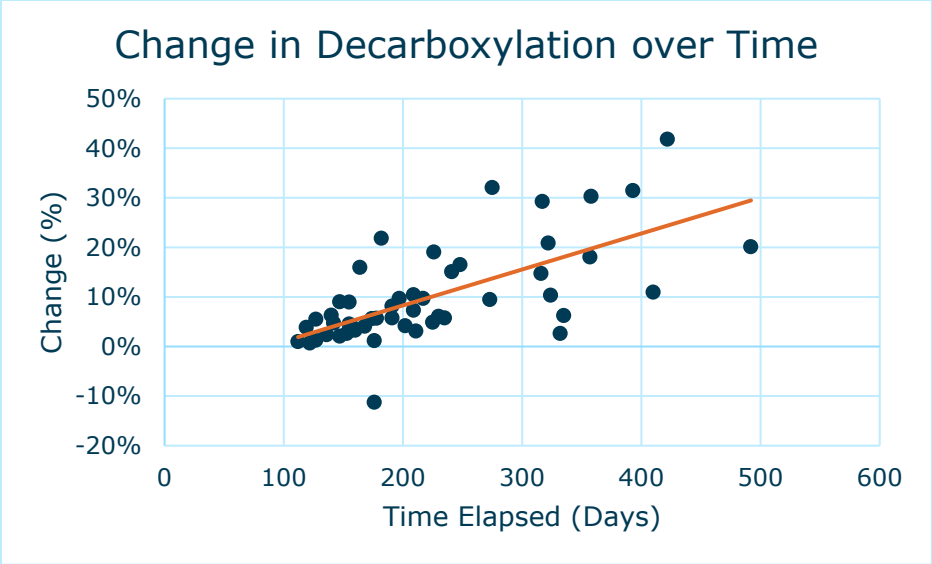


Figure 15. Change in proportion of decarboxylated THC over time

Predictably, there appeared to be a relationship between time elapsed between tests and the conversion of THCA to delta-9-THC, represented in Figure 15 as the change in the ratio of delta-9-THC to total THC between the third-party laboratory test and the CRL test. However, when we compared the time elapsed between tests against the change in total THC, there was no significant relationship (Figure 16).

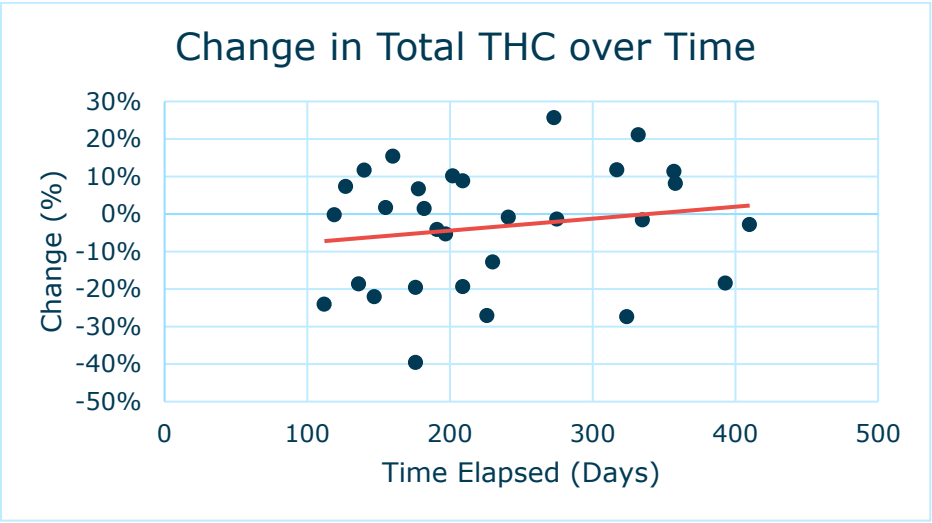


Figure 16. Change in total THC over time

[33] The proportion of decarboxylation was calculated as [delta-9-THC]÷[total THC]. The change in decarboxylation was calculated as the difference of the proportion of decarboxylation in the CRL results and in the third-party laboratory results.

If total THC degrades significantly as a function of time, this effect appears to be entirely drowned out by other factors in this data set. Differences in testing methodology and representativeness of samples between the CRL and third-party laboratories may be significant confounding factors. If so, it is very interesting that this effect is strong enough to obscure any correlation in the change in total THC over time but not in the decarboxylation of THC over time.

THE POWER OF PRICE ON POTENCY

Regulators have received many complaints from the industry regarding the strong influence of potency test results on cannabis flower prices set by wholesalers and retailers. As a result, producers reportedly feel significant pressure to have their cannabis be tested and labeled with the highest possible THC results to ensure a marketable crop at a competitive price point.

SALES VOLUME BY TOTAL THC

In order to investigate this claim, we reviewed CTS sales and THC potency data for all sales of marijuana categorized as "Bud" to consumers at retail locations in 2024. We restricted the query to sales of cannabis in quantities of less than an ounce to avoid introducing the variable "bulk" discounting practices on the data.

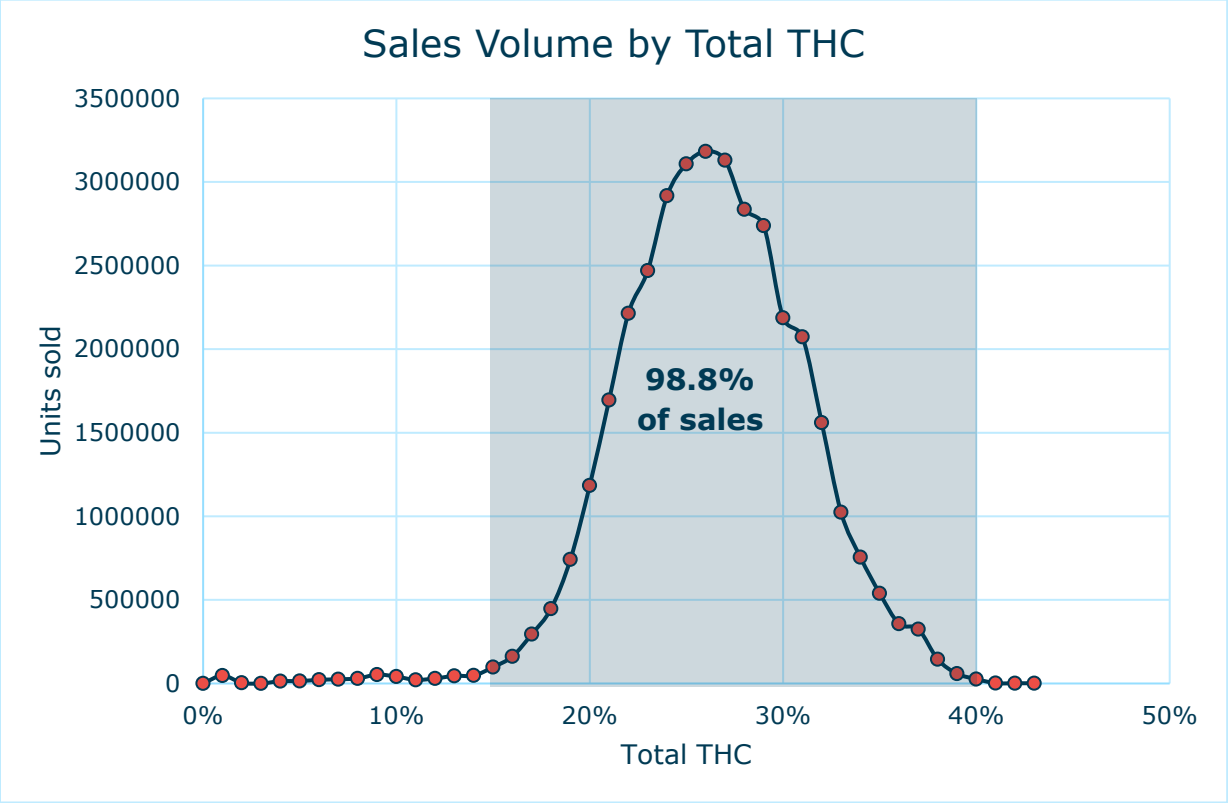


Figure 17. Sales volume of "Buds" by total THC concentration

We found that 98.8% of all units sold had total THC potency between 15–40% and that 92.9% of all units sold had total THC potency of 20% or greater. This seems to broadly corroborate the claim that lower THC flower has far more limited sales potential.

AVERAGE PRICE PER GRAM OF FLOWER BY TOTAL THC

We then reviewed the average price of each unit sold within each reported increment of 0.1% total THC. As an example, there were 1,258,421 sales from packages of marijuana flower that had 25.9% total THC, which on average sold for $4.75 per gram. When viewed in aggregate, this data tells a compelling story.

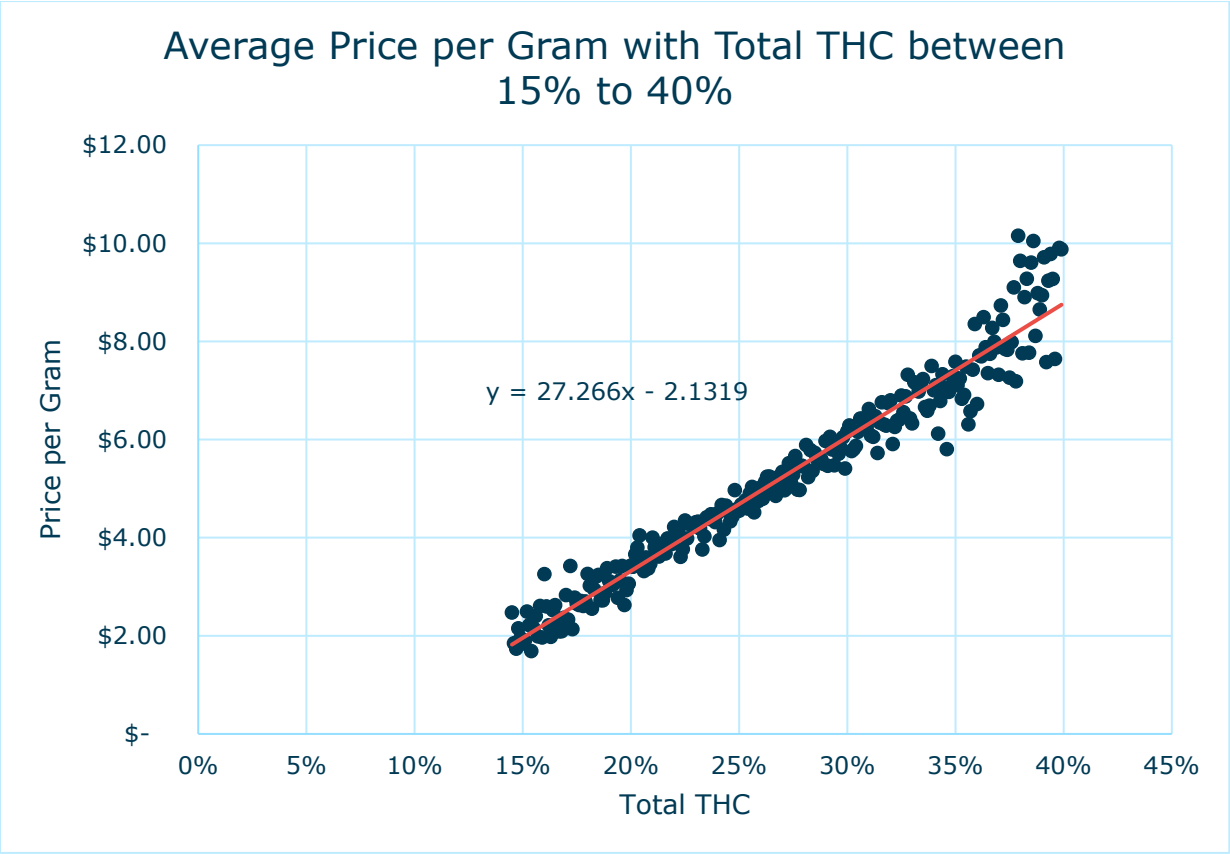


Figure 18. Average price per gram by total THC concentration

The correlation between reported total THC concentration and sale price is undeniable. While marijuana licensees differentiate their flower harvests through many different means (brand, strain, terpene profile, harvest date, etc.), it seems that total THC content has an extremely strong effect on retail pricing. On average, based on the fit line on Figure 18, each additional percentage point of total THC could translate to an additional $270 of retail sales per kilogram of flower. This finding is consistent with what licensees have reported to OLCC.

In collecting and testing packages for Operation Clean Leaf, we sought to evaluate the reported potency advertised on the label compared with the potency observed when testing the products at the CRL. This also allows for comparison of the relative accuracy of marijuana products within the OLCC market to hemp products sold in the general market.

COMPARISON WITH CRL RESULTS

Comparing the results of CRL testing for total THC with the third-party laboratory results for marijuana flower shows discrepancies that are consistent with the observed pricing and sales trends. Among relatively lower-potency marijuana samples – samples that the CRL found to contain less than 20% total THC – the discrepancy between the results from the third-party laboratory and the CRL was much larger (mean and standard deviation +27.3% ±17.1%). Among higher-potency marijuana samples – samples that the CRL found to contain more than 20% total THC – the average discrepancy between the results from the third-party laboratory and the CRL was smaller (mean and standard deviation +6.2% ±16.7%).

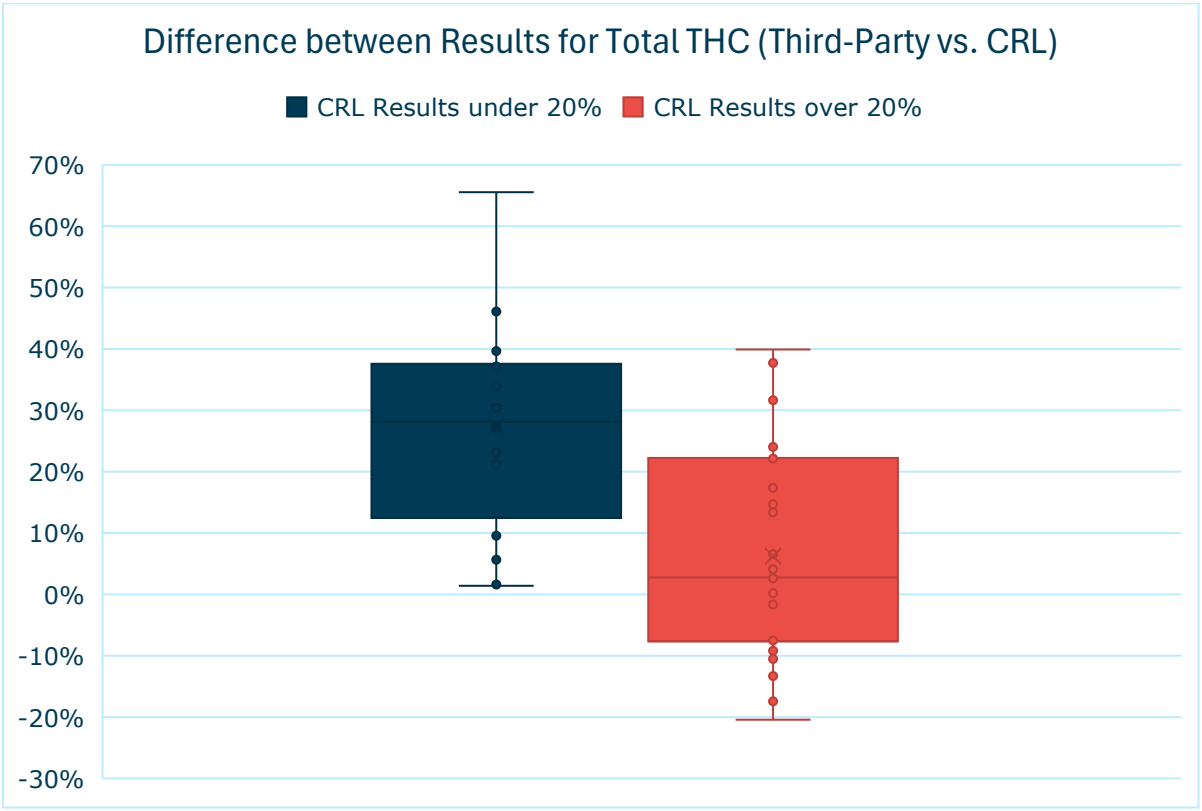


Figure 19. Difference between total THC reported by third-party laboratory compared with CRL results in marijuana flower samples

When reviewing this data, we wanted to compare it to the hemp flower samples that are sold as "THCA hemp" flower (page 23). Of the 31 hemp flower samples in this category, 28 had alleged concentrations of total THC on their labels, on the websites the samples were purchased from, or on COAs associated with the sample. This alleged potency information was compared with results from the CRL.

There is a substantial difference in the discrepancies between alleged potency and CRL results for lower-potency samples compared with higher potency samples. Among the relatively lower-potency "THCA hemp" – samples that the CRL found to contain less than 20% total THC – the discrepancy between the alleged potency and the results from the CRL was much larger (mean and standard deviation +48.2% ±34.7%). Among higher-potency

"THCA hemp" – samples that the CRL found to contain more than 20% total THC – the discrepancy between alleged potency and the results from the CRL was smaller (mean and standard deviation −0.6% ±17.6%).

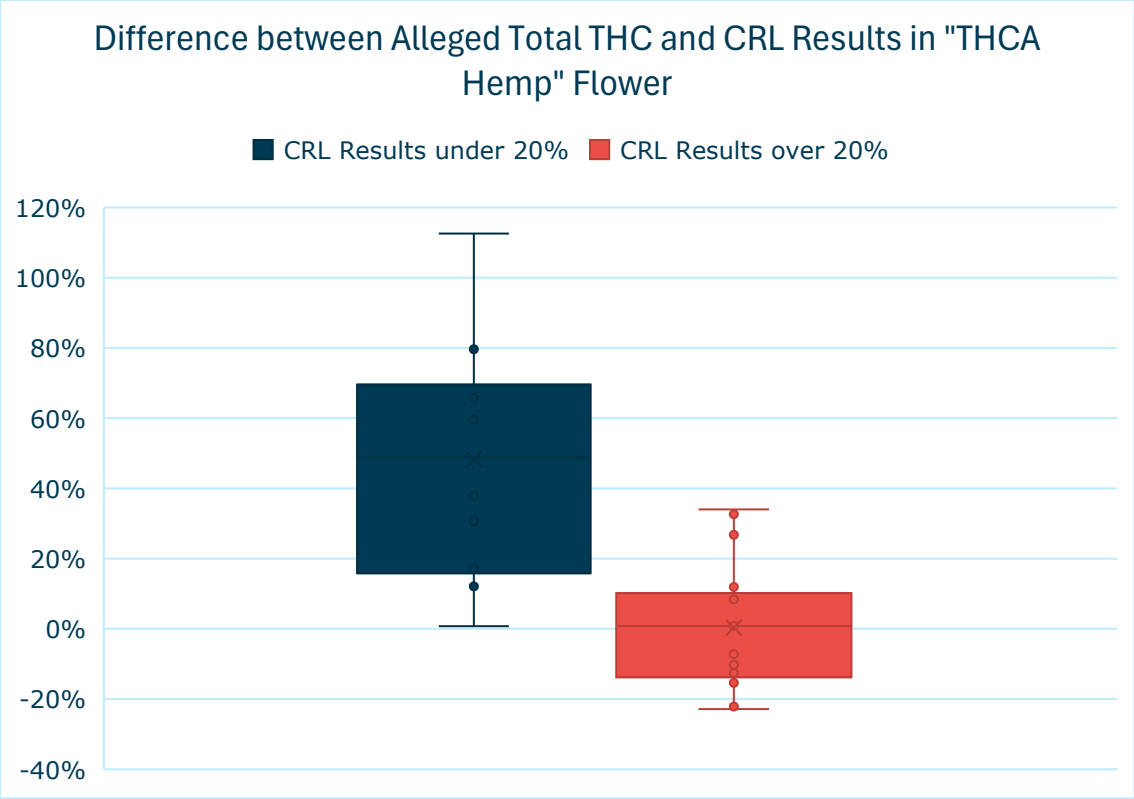


Figure 20. Difference between total THC reported by CRL compared with alleged total THC concentration in "THCA hemp" flower samples

WHAT DOES THIS MEAN?

Initially, when viewing the marijuana data in a vacuum, one hypothesis was that Oregon's oversupply of marijuana (Oregon Liquor and Cannabis Commission, 2023) created intense competition for market share, exerting increased pressure to inflate potency results on marijuana flower. That pressure would be especially high on lower the potency flower batches which would have difficulty securing space on retail shelves. However, in light of the hemp data, it seems there are similar forces at play in both the Oregon marijuana market and the national hemp flower market. This could be an indication that the pressure for flower to test above 20% total THC is reflective of broader cannabis consumer preferences at the national level.

HEMP EDIBLES

Fifty samples of cannabinoid edible products sold as "hemp" have been submitted to the CRL for potency testing. OLCC will report on the results when this data is received.

AGE VERIFICATION

The vast majority of the hemp products purchased for Operation Clean Leaf were sold without appropriate age verification. A web site simply asking for the customer to enter a date of birth or click a button stating the customer was at least 21 (or in some cases, 18) years of age was not considered appropriate age verification. Online age verification was considered appropriately completed if an online retailer requested further proof of age, such as a photo of a valid ID, a photo of the ID and a "selfie," or a photo of an ID and a "selfie" holding the ID and credit card with matching name. In-person retailers were considered to have appropriately verified age if they required a valid form of ID as defined in ORS 475C.217. This would include a driver's license, state-issued identification card, passport, etc.

50 useable marijuana flower samples were purchased from 19 OLCC-licensed retailers. Of the 19 purchases, 18 were done in an undercover capacity. All OLCC-licensed marijuana retailers required a valid form of ID to complete the sale.

Oregon laws and rules prohibit the sale of adult use cannabis items,[34] including hemp items that meet certain criteria, to a person under 21 years of age in Oregon's general market.

Five in-person purchases of "hemp" flower (all of which were adult use cannabis items) from the general market were completed. None of these retailers required valid ID. The purchaser did not disclose that he worked for OLCC except in one case. 17 "hemp" edibles were obtained by in-person purchases. Based on label claims and COAs, 11 of these fit the definition of an adult use cannabis item; none of the retailers who sold these 11 products required valid ID as proof of age. However, all in-person purchases were completed by an adult male, 59 years of age.

In addition, 46 samples of "hemp" flower or "THCA" flower (all of which were adult use cannabis items) were purchased from 45 online retail websites. Only 6 of these retailers required the purchaser to provide proof of age beyond clicking a button claiming to be over 21 or entering a date of birth.

Of the 50 "hemp" edibles, 33 were obtained from 27 online retailers. Based on label claims and COAs, 32 of the 33 items fit the definition of adult use cannabis items. Only three of these retailers required the purchaser to provide proof of age beyond clicking a button claiming to be over 21 or entering a date of birth.

[34] OAR 845-026-0300; OAR 603-048-1500(4); ORS 571.339(4). A hemp item is an "adult use cannabis item" if the item contains 0.5 mg or more delta-9-THC, THCA, or delta-8-THC in the entire container; if the testing was insufficiently sensitive to show that the product does not exceed 0.5 mg; if the product contains any artificially derived cannabinoids; or if the product contains 0.5 mg or more of any other cannabinoid advertised by the manufacturer or seller as having an intoxicating effect.

CONCLUSION

Through Operation Clean Leaf, OLCC staff were able to successfully purchase a large amount of prohibitively high THC cannabis flower and edible products from internet retailers and unlicensed retail stores. This demonstrates the need for a robust collaborative regulatory approach to address this ongoing national issue.

Testing cannabis samples with the CRL has provided valuable data to understand and interpret trends within the cannabis industry.

Potency testing on marijuana flower tended to corroborate anecdotal reports that OLCC has received about the prevalence of third-party laboratory test results overstating the concentration of total THC in marijuana flower. Comparing these results with pricing trends observed in OLCC Metrc data paints a picture of the competing incentives that underlie potency testing. The extent to which discrepancies between total THC results from the CRL results and from third-party laboratories are explained by laboratory methods and practices or actions taken by the licensee requesting the testing requires further investigation.

Due to the significant differences between CRL results and third-party laboratory results, we were unable to gain insight into the natural changes in potency over time between harvest, initial testing, and ultimate sale to a consumer. OLCC staff will continue to monitor research regarding the shelf stability of THC and evaluate whether further research with the CRL is warranted.

The discovery of a cannabis product that contained a prohibited amount of pesticide being sold to consumers demonstrates the need for continued collaboration with the CRL in off-the-shelf audit testing. It is clear that the state has further need to explore the prevalence of pesticides with preliminary detections in the non-targeted pesticide testing.

Test results for hemp products that were able to be purchased in Oregon indicates widespread non-compliance with Oregon's regulations on the sale of hemp to consumers. Oregon was the first state to adopt regulations addressing and mitigating potential harms of intoxicating "hemp" products, and Oregon's regulatory scheme for cannabinoid hemp products is one of the most robust in the nation. However, it appears that retailers within Oregon and in other states continue to sell prohibited products to Oregon consumers, often without adequate age verification to ensure potentially intoxicating products stay out of the hands of minors.

The test results for "THCA hemp" flower were especially noteworthy. Many businesses nationwide are selling high-THC cannabis flower to consumers with minimal regulation. These sales are premised on the claim that the flower is hemp under federal law because it contains no more than 0.3% delta-9-THC, regardless of the high levels of total THC. The test results from the CRL show that this is simply not true.

Every sample of "THCA hemp" tested by the CRL contained well over 0.3% delta-9-THC. This is cannabis that clearly appears to be "marijuana" and is being imported into Oregon and sold to Oregon consumers, often without adequate age verification. Oregon taxes the retail sale of marijuana, and this tax revenue benefits Oregonians through distributions to cities, counties, schools, Oregon State Police, and the Oregon Health Authority. In addition

to the public health and safety hazards presented by the unregulated sale of marijuana, businesses selling marijuana labeled as "hemp" outside of Oregon's regulated system also deprive the state of revenue for those sales.

We will update this report once we receive the remaining test results from the CRL. Already, the data we have received has provided actionable results to protect against threats to public health and provided insights to better inform data-driven cannabis policy. We look forward to continued collaboration with the CRL to further investigate areas of regulatory concern and interest.

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APPENDIX A: TARGETED ANALYTES (PESTICIDE TESTING)

Compound	Source of Concern	Compound	Source of Concern
3-phenoxybenzaldehyde	California	**Chlorfenapyr**	Oregon
Fenobucarb	California	**Malathion**	Oregon
Isoprocarb	California	**Chlorpyrifos**	Oregon
Methyl-isothiocynate	California	**Spiromesifen**	Oregon
Metrifonate	California	**Myclobutanil**	Oregon
Pentachloro benzonitrile	California	**Permethrins**	Oregon
PCNB	California	**Metalaxyl**	Oregon
Procymidone	California	**DDVP [Dichlorvos]**	Oregon
Profenofos	California	**Abamectin**	Oregon
Thiophanate-methyl	California	**Acephate**	Oregon
Tridemorph	California	**Carbaryl**	Oregon
Fenpropathrin	California	**Trifloxystrobin**	Oregon
Chlorthiophos	California	**Paclobutrazol**	Oregon
Chlorthalonil	California	**Etoxazole**	Oregon
Pyrimethanil	California	**Bifenazate**	Oregon
Pymetrozine	California	**MGK-264**	Oregon
Fenvalerate	California	**Fenpyroximate**	Oregon
Methamidophos	California	**Cypermethrin**	Oregon
Fumitoxin	California	**Acequinocyl**	Oregon
Propamocarb	Canada	**Propiconazole**	Oregon
Teflubenzuron	Canada	**Cyfluthrin**	Oregon
Praclostrobin	Canada	**Azoxystrobin**	Oregon
Fluopyram	Canada	**Chlorantraniliprole**	Oregon
Buprofezin	Canada	**Boscalid**	Oregon
Metazachlor	Canada	**Prallethrin**	Oregon
Dichlobenil	Canada	**Spirotetramat**	Oregon
Malaoxon	Canada	**Ethoprophos**	Oregon
Spirodiclofen	Canada	**Etofenprox**	Oregon
Tetramethrin	Canada	**Tebuconazole**	Oregon
Pyrethrins	Oregon	**Fludioxonil**	Oregon
Spinosad	Oregon	**Imazalil**	Oregon
Piperonyl_butoxide	Oregon	**Fipronil**	Oregon
Bifenthrin	Oregon	**Diazinon**	Oregon
Imidacloprid	Oregon	**Naled**	Oregon
Pyridaben	Oregon		

APPENDIX B: EXPANDED LCMS LIST (PESTICIDE TESTING)

(TPPA) Triphenyl phosphate	Dinitramine	Iprodione	Propham
Acephate	Emamectin B1b benzoate	Isocarbamide	Propiconazole
Acetamiprid	Epoxiconazole (BAS 480F)	Isoprocarb	Proquinazid
Acetochlor	Esfenvalerate	Isoxaben	Pyracarbolid
Aldicarb	Ethiofencarb sulfoxide	Isoxadifen-ethyl (AE F122006)	Pyrazophos
Allethrin	Ethoxyquin	Isoxathion	Pyrifenox
Amitraz metabolite DMF	Etoxazole	Kresoxim methyl	Pyrimethanil
Avermectin B1a (Abamectin B1a)	Famoxadon	Linuron	Pyriproxyfen
Azoxystrobin	Fenarimol	Lufenuron	Pyroquilon
Beflubutamid	Fenazaquin	Mepanipyrim	Resmethrin
Bendiocarb	Fenbutatin oxide	Mepanipyrim-2-hydroxypropyl	Rimsulfuron
Bensulide	Fenpropathrin	Mephosfolan	Secbumeton
Bentazone	Fenpropidin	Mesosulfuron-methyl	Sethoxydim
Bifenazate (D 2341)	Fenpropimorph (Ro 14-3169)	Metaflumizone	Sethoxydim I
BTS 27919 (N-(2,4-dimethylphenyl) formamide)	Fenpyroximate(E)	Metazachlor	Sethoxydim II
Butocarboxim-sulfoxide	Fensulfothion oxon sulfone	Methamidophos	Simetryn
Butoxycarboxim	Fensulfothion sulfone	Methidathion	Spiromesifen enol
Carbaryl	Fenthion	Methoxyfenozide	Spiroxamine
Chlorotoluron	Fenthion-oxon	Metolachlor	Tebufenoxide
Chlorpyriphos	Fenthion-oxon-sulfoxide	Metolcarb	Tebuthiuron
Clomazone	Fentrazamid (Innova)	Metosulam	Tepraloxydim I
Cloquintocet-mexyl	Flonicamid	Mexacarbate	Tepraloxydim II
Clothianidin	Fluazifop-butyl	Molinate	Thiabendazole
Cycloxydim	Flucarbazone-sodium	Neburon (Phosphoramidothioic acid)	Thiamethoxam
Cyflufenamid	Fludioxonil	Novaluron	Thiazopyr
Cymoxanil (Curzate)	Flufenacet (Fluthiamide)	Ofurace	Thidiazuron
Demeton-S (disulfoton oxon)	Flumethrin	Oxamyl oxime	Thifensulfuron-methyl (DPX-M6316)

Demeton-S-methylsulfoxide	Fluometuron	Oxydemeton-methyl (Demeton-S-methylsulfoxide)	Thiofanox-Sulfoxide
Dialifos	Fluoxastrobin	Paclobutrazol	Thionazin (Zinophos)
Diazinon oxon	Flusilazol	Paraoxon-methyl	Thiophanate-methyl
Dichlofluanid	Flutolanil	Phorate Sulfone	Tifatol (Cymiazole)
Diclobutrazol	Formothion	Phorate Sulfoxide	Topramezone
Diclocymet	Furalaxyl	Phosalone	Tralkoxydim
Dicrotophos (Bidrin)	Halofenozide	Piperonyl butoxide	Triadimenol
Difenconazole	Haloxyfop	Prochloraz	Tribufos
Diflubenzuron	Hexaflumuron	Procymidon	Tridemorph
Dimetilan	Hydramethylnon	Promecarb	Trifloxysulfuron (sodium)
Diniconazole	Imidacloprid	Propaquizafop	Trimethacarb
			Zoxamide

APPENDIX C: EXPANDED GCMS LIST (PESTICIDE TESTING)

(Full list still being determined)

APPENDIX D: PACKAGING AND LABELING SCORING MATRIX

Sample ID	Product	Adult Use	Purchased	Label Type	Clear Potency	Prohibited Potency	Link to Lab Results	Identified Serving Size	Prohibited Active Ingredients	Prohibited Ingredient Notes	Allergens Disclosed	Child Resistance
M24-06518-029-HEMP-2	JUST CBD CBD+THC ORANGE SLICES	Yes	In Person	Supplement	No	Yes	No	Yes	No		NA	Yes
M24-06520-029-HEMP-3	MAXTON HEALTH HEMP GUMMY BEARS	Unknown	In Person	Supplement	Yes	No	No	Yes	Yes	Melatonin	NA	No
M24-06556-029-HEMP-4	PROCANA CBD BALANCE CHEWS	Unknown	In Person	Supplement	Yes	No	No	Yes	No		NA	Yes
M24-06633-029-HEMP-5	BLUEBERRY CBD GUMMIES GREENGENE	Yes	In Person	Food	Yes	No	Yes	Yes	No		NA	No
M24-06634-029-HEMP-6	KINGDOM CANNABINOIDS THE DAY TRIPPER HHC 25MG 5CT	Yes	In Person	Supplement	Yes	Yes	No	Yes	No		NA	Yes
M24-06634-029-HEMP-7	WORKMANS RELIEF PUNCH IN 25MG CBD	Yes	In Person	Supplement	Yes	No	No	Yes	No		NA	Yes
M24-06635-029-HEMP-8	URB D9 THC GUMMIES DRAGONBERRY LEMONADE 10MG EA 35CT	Yes	In Person	Food	Yes	Yes	Yes	Yes	No		NA	Yes
M24-06635-029-HEMP-9	DELTA BOSS D8 WATERMELON WEDGE 500MG	Yes	In Person	Food	No	Yes	No	Yes	No		NA	No
M24-06637-029-HEMP-10	SOLUTION PREMIUM CBD GUMMIES 30CT	Unknown	In Person	Supplement	Yes	No	No	Yes	No		NA	No
M24-06637-029-HEMP-11	SEVENTH HILL CBG GUMIES 10CT WHITE PEACH	Yes	In Person	Food	No	No	Yes	No	No		NA	Yes
M24-06581-029-HEMP-12	HASH HOUSE GEM LIVE ROSIN HHC GUMMIES 500MG WATERMELON 10CT	Yes	Online	Unclear	No	Yes	No	Yes	No		NA	Yes
M24-06593-029-HEMP-14	WATERMELON HEMP GUMMIES 1:1 CBD:D9 20MG EA 10CT	Yes	Online	Unclear	No	Yes	No	No	Unknown	No ingredients	Unknown	No
M24-06667-029-HEMP-16	BUDD CBD DREAM DROPS	No	In Person	Food	Yes	No	No	Yes	Yes	Melatonin	NA	No
M24-06703-029-HEMP-18	PEACHES & DREAM INFUSED GUMMIES D9 EDIBLE 10CT HYBRID	Yes	Online	Food	No	Yes	No	Yes	No		NA	Yes
M24-07384-029-HEMP-22	SUNMED NEURO GUMMIES	Yes	In Person	Supplement	No	Other	No	Yes	No		NA	Yes
M24-07276-029-HEMP-26	PACKWOOD D9 GUMMIES 3600MG PASSION FRUIT PUNCH	Yes	Online	Food	Yes	Yes	No	Yes	No		NA	Yes
M24-07277-029-HEMP-29	12MG D9 THC EDIBLES	Yes	Online	Unclear	Yes	Yes	No	Yes	Unknown	No ingredients	No ingredients	Yes
M24-07320-029-HEMP-30	HEMP BOMB HIGH POTENCY HEMP GUMMIES	Yes	Online	Food	Yes	No	No	Yes	No		NA	No
M24-07273-029-HEMP-32	DADS GRASS DELUXE THC + CBD GUMMIES	Yes	Online	Food	Yes	No	No	Yes	No		NA	No
M24-07503-029-HEMP-34	CANVAST FOCUS D9+THCV GUMMIES	Yes	Online	Food	Yes	Yes	No	Yes	No	Magnesium L-threonate (GRAS)	NA	Yes
M24-07200-029-HEMP-37	DELTA 8 2000MGS SKITTLEZZZ	Yes	Online	Food	No	Yes	No	Yes	No		NA	No
M24-07200-029-HEMP-121	THCO 2000MGS SKITTLEZZZ	Yes	Online	Food	No	Yes	No	Yes	No		NA	No
M24-07200-029-HEMP-122	HHC 2000MGS SKITTLEZZZ	Yes	Online	Food	No	Yes	No	Yes	No		NA	No
M24-07499-029-HEMP-40	HEMP LIVING PURE DELTA 8 GUMMIES HIGH POTENCY PACK 500MG 20CT - RAINBOW	Yes	Online	Food	No	Yes	No*	Yes	No		NA	Yes
M24-07499-029-HEMP-41	HEMP LIVING SOUR SERIES DELTA 9 GUMMIES - 100MG D9 THC 10CT - BLUEBERRY LEMONADE	Yes	Online	Food	Yes	Yes	No*	Yes	No		NA	Yes
M24-07499-029-HEMP-42	HEMP LIVING HEAVYWEIGHT GUMMIES THC-P + D8 + D9 200MG - 2CT - RAINBOW CANDY	Yes	Online	Food	Yes	Yes	No*	Yes	No		NA	No

Product	Attractive to Minors (Label)	Attractive to Minors (Product Shape)	Health Claims or Misleading Claims	Warning Statements	Warning Symbol	ID Verification	Lot/Batch ID	General Notes
JUST CBD CBD+THC ORANGE SLICES	No	No	No	Yes	Yes	No	Yes	Font size and color are nearly illegible
MAXTON HEALTH HEMP GUMMY BEARS	Yes	Yes	Yes*	Yes	No	No*	No	Most likely misleading due to "organically grown" claim; gummy bear shape; package says "18+"; no test results available to verify if product is "adult use"
PROCANA CBD BALANCE CHEWS	No	No	Yes	Yes	No	No*	Yes	Expired 3/12/23; no test results available to verify if product is "adult use"
BLUEBERRY CBD GUMMIES GREENGENE	No	Unknown	No	Yes	No	No*	No	Lab results do not match product (different lot/color)
KINGDOM CANNABINOIDS THE DAY TRIPPER HHC 25MG 5CT	No	Unknown	No	No	No	No	No	
WORKMANS RELIEF PUNCH IN 25MG CBD	No	Unknown	No	Yes	No	No*	No	Claims "Non-detect THC at <0.1%"; testing not sensitive enough to show <0.5 mg THC per package
URB D9 THC GUMMIES DRAGONBERRY LEMONADE 10MG EA 35CT	No	No	No	Yes	No	No	Yes	
DELTA BOSS D8 WATERMELON WEDGE 500MG	No	Yes	No	Yes	No	No	No	Font illegible; image of smoking
SOLUTION PREMIUM CBD GUMMIES 30CT	No	Yes	No	Yes	No	No	No	Claims "THC-free"; no test results available to verify if product is "adult use"
SEVENTH HILL CBG GUMIES 10CT WHITE PEACH	No	Unknown	No	Yes	Yes	No	Yes	Testing not sensitive enough to show <0.5 mg THC per package
HASH HOUSE GEM LIVE ROSIN HHC GUMMIES 500MG WATERMELON 10CT	No	No	No	Yes	No	No	Yes	
WATERMELON HEMP GUMMIES 1:1 CBD:D9 20MG EA 10CT	No	No	No	Yes	Yes	No	No	No ingredients listed
BUDD CBD DREAM DROPS	No	No	No	Yes	No	No*	Yes	Expired July 2024; "Zero-THC"
PEACHES & DREAM INFUSED GUMMIES D9 EDIBLE 10CT HYBRID	No	No	Yes	Yes	Yes	No	No	Serving size is 1 but label says "Take 1/2"
SUNMED NEURO GUMMIES	No	No	No	Yes	No	No*	Yes	CoA says 39mg of cannabinoids not 30. Label says "Less than 0.3% delta 9"
PACKWOOD D9 GUMMIES 3600MG PASSION FRUIT PUNCH	No	Unknown	Yes	Yes	No	No*	Yes	Label says <0.3% THC but potency (3600 mg ÷ 75 g) is >4% THC; product is expired
12MG D9 THC EDIBLES	No	No	No	Yes	Yes	No	No	No ingredients listed; no manufacturer information
HEMP BOMB HIGH POTENCY HEMP GUMMIES	Yes	Unknown	Yes	Yes	No	No	No	CBD concentration on label is much lower than COA indicates
DADS GRASS DELUXE THC + CBD GUMMIES	Yes	No	No	Yes	No	No	Yes	Smiley faces on back of label
CANVAST FOCUS D9+THCV GUMMIES	No	Unknown	Yes*	Yes	Yes	No	Yes	Says "Organic" on front of label, but no organic symbol; illegible text (right side of package)
DELTA 8 2000MGS SKITTLEZZZ	No	Yes	No	Yes	No	No*	No	Largely illegible text
THCO 2000MGS SKITTLEZZZ	No	Yes	No	Yes	No	No*	No	Largely illegible text
HHC 2000MGS SKITTLEZZZ	No	Yes	No	Yes	No	No*	No	Largely illegible text
HEMP LIVING PURE DELTA 8 GUMMIES HIGH POTENCY PACK 500MG 20CT - RAINBOW	No	No	No	Yes	No	Yes	No	Says <0.3% THC
HEMP LIVING SOUR SERIES DELTA 9 GUMMIES - 100MG D9 THC 10CT - BLUEBERRY LEMONADE	No	Unknown	No	Yes	No	Yes	No	Says <0.3% THC
HEMP LIVING HEAVYWEIGHT GUMMIES THC-P + D8 + D9 200MG - 2CT - RAINBOW CANDY	No	Unknown	No	Yes	No	Yes	Yes	Says <0.3% THC

Sample ID	Product	Adult Use	Purchased	Label Type	Clear Potency	Prohibited Potency	Link to Lab Results	Identified Serving Size	Prohibited Active Ingredients	Prohibited Ingredient Notes	Allergens Disclosed	Child Resistance
M24-07499-029-HEMP-43	HEMP LIVING NITE-TIME GUMMIES 300MG D8 + 180MG CBN - WATERMELON	Yes	Online	Food	Yes	Yes	No*	Yes	No		NA	Yes
M24-07774-029-HEMP-52	PLATINUM CBD+ SWEET BEARS	Unknown	In Person	Food	No	No	No	Yes	No		NA	Yes
M24-07775-029-HEMP-53	INFUSED CANNABIDIOL CBD MAGIC LEAF GUMMY CANDIES	Unknown	In Person	Food	No	Other	No	Yes	No		NA	No
M24-08093-029-HEMP-72	NULEAF NATURALS FULL SPECTRUM D9 THC GUMMIES	Yes	In Person	Supplement	No	Yes	Yes	Yes	No		NA	Yes
M24-07959-029-HEMP-73	CYCLING FROG PASSIONFRUIT GUMMIES, 10MG THC + 10MG CBD	Yes	Online	Supplement	Yes	Yes	Yes	Yes	No		NA	Yes
M24-07202-029-HEMP-75	BOLT CBD PEACH GUMMY RINGS	Unknown	In Person	Unclear	No	No	No	No	Unknown	No ingredients	Unknown	No
M24-06606-029-HEMP-76	CANNABUDDY DELTA 8 + DELTA 9 TRIPLE LAYER BEARS 40MG D8 + 40MG D9	Yes	Online	Food	Yes	Yes	No	Yes	No		NA	Yes
M24-06606-029-HEMP-77	GALAXY TREATS DELTA 8 + DELTA 9 THCP GUMMIES - BERRY MELON LIFTER	Yes	Online	Food	No	Yes	Yes	Yes	No		NA	Yes
M24-06700-029-HEMP-79	DAY DRIFT HYBRID GUMMIES 100MG	Yes	Online	Food	Yes	Yes	Yes	Yes	No		Yes	Yes
M24-07996-029-HEMP-110	HULKAMANIA BODYSLAM THC GUMMIES - WATERMELON CRUSH	Yes	Online	Supplement	Yes	Yes	No	Yes	No		NA	Yes
M24-08421-029-HEMP-120	GUMMY GIRL WEEKEND VIBES	Yes	Online	Unclear	No	Yes	No	Yes	No		NA	Yes
M24-08415-029-HEMP-115	GOLD SPECTRUM 100MG 40CT WATERMELON	Yes	Online	Food	No	Yes	Yes	Yes	No		NA	Yes
M24-07989-029-HEMP-111	MR HEMP FLOWER D9 GUMMIES	Yes	Online	Food	No	Yes	Yes	Yes	No		NA	Yes
M24-08417-029-HEMP-119	TRRLLI STRAWBERRY PUFFS MEDICATED 600MG THC	Yes	Online	Unclear	No	Yes	No	No	Unknown		Unknown	Yes
M24-08472-029-HEMP-128	CALIGREENGOLD GUMMIES 250MG THC 25CT	Yes	Online	Food	Yes	Yes	Yes	Yes	No		Yes	No
M24-08823-029-HEMP-131	JOLLY RANCHER GUMMIES 600MG	Yes	Online	Unclear	No	Yes	No	No	Unknown	No ingredients	Unknown	No
M24-09081-029-HEMP- 137	BEARLY LEGAL D9 GUMMIES	Yes	Online	Unclear	Yes	Yes	No	Yes	Unknown	No ingredients	Unknown	Yes
M24-09114-029-HEMP-144	VENERA GUMMY THCA+D9+THCP - BLUE RASPBERRY	Yes	Online	Food	No	No	No	Yes	No		No	No
M24-09110-029-HEMP-141	HIXOTIC DELTA-9 THC GUMMIES 2CT - PEACH PEAR PUNCH	Yes	Online	Unclear	Yes	Yes	No	Yes	No		No	No
M24-07969-029-HEMP-147	NICK'S NUGS OG D9 GUMMIES 10MG D9 + 75MG CBD EA 10CT	Yes	Online	Food	Yes	Yes	No	Yes	No		No	No
M24-07969-029-HEMP-148	CONSIDERITFLOWER ARTISAN GUMMY INDICA REAL STRAIN FIX 1CT CHERRY	Yes	Online	Unclear	Yes	Yes	No	Yes	Unknown	No ingredients	Unknown	No
M24-04041	THE DEMON DELTA-8 GUMMIES	Yes	Online	Unclear	Yes	Yes	No	Yes	Unknown	Unspecified ingredient	No	No
M24-04002	LOUD CLOUD DELTA-8 GUMMIES	Yes	Online	Unclear	Yes	Yes	No	Yes	Unknown	Unclear	No	No
M24-04658	BLISS MELON GUMMIES	Yes	Online	Food	Yes	Yes	Yes	Yes	No		No	No

Product	Attractive to Minors (Label)	Attractive to Minors (Product Shape)	Health Claims or Misleading Claims	Warning Statements	Warning Symbol	ID Verification	Lot/Batch ID	General Notes
HEMP LIVING NITE-TIME GUMMIES 300MG D8 + 180MG CBN - WATERMELON	No	Unknown	No	Yes	No	Yes	Yes	Says <0.3% THC
PLATINUM CBD+ SWEET BEARS	Yes	Yes	No	Yes	No	No	No	Says <0.03% THC; no test results available to verify if product is "adult use"
INFUSED CANNABIDIOL CBD MAGIC LEAF GUMMY CANDIES	No	Yes	No	Yes	No	No	No	Says <0.3% THC; no test results available to verify if product is "adult use"
NULEAF NATURALS FULL SPECTRUM D9 THC GUMMIES	No	No	No	Yes	No	No*	Yes	Says <0.3% THC
CYCLING FROG PASSIONFRUIT GUMMIES, 10MG THC + 10MG CBD	Yes	Unknown	No	Yes	No	No*	Yes	Says <0.3% THC; included ingredient list despite using supplement template
BOLT CBD PEACH GUMMY RINGS	No	Yes	Yes	Yes	No	No*	No	Says it reduces anxiety (health claim); "THC free"; no test results available to verify if product is "adult use"
CANNABUDDY DELTA 8 + DELTA 9 TRIPLE LAYER BEARS 40MG D8 + 40MG D9	Yes	Yes	No	Yes	No	No*	No	
GALAXY TREATS DELTA 8 + DELTA 9 THCP GUMMIES - BERRY MELON LIFTER	Yes	No	No	Yes	Yes	No	Yes	
DAY DRIFT HYBRID GUMMIES 100MG	Yes	No	No	Yes	No	No	Yes	
HULKAMANIA BODYSLAM THC GUMMIES - WATERMELON CRUSH	No	Unknown	No	Yes	Yes	No	Yes	Contains MCT oil; may be derived from an allergen
GUMMY GIRL WEEKEND VIBES	No	No	No	Yes	Yes	No	No	
GOLD SPECTRUM 100MG 40CT WATERMELON	No	No	No	Yes	No	No	Yes	<0.3% d9-THC
MR HEMP FLOWER D9 GUMMIES	Yes	No	No	Yes	Yes	No	No	<0.3% d9-THC
TRRLLI STRAWBERRY PUFFS MEDICATED 600MG THC	Yes	No	No	Yes	Yes	No	No	Says this product contains cannabis, a Schedule I controlled substance
CALIGREENGOLD GUMMIES 250MG THC 25CT	No	No	No	Yes	No	No*	No	
JOLLY RANCHER GUMMIES 600MG	No	No	No	No	No	No	No	Website claims 50mg per piece 600mg per gummy.
BEARLY LEGAL D9 GUMMIES	Yes	No	No	Yes	No	Yes	No	Smiley face on label; serving size is 1/4 of a gummy; no ingredients listed
VENERA GUMMY THCA+D9+THCP - BLUE RASPBERRY	No	Unknown	No	Yes	No	No	No	
HIXOTIC DELTA-9 THC GUMMIES 2CT - PEACH PEAR PUNCH	No	Unknown	No	Yes	No	No	No	Has ingredient list (like a food label) but no nutritional information panel
NICK'S NUGS OG D9 GUMMIES 10MG D9 + 75MG CBD EA 10CT	No	No	No	Yes	Yes	Yes	No	
CONSIDERITFLOWER ARTISAN GUMMY INDICA REAL STRAIN FIX 1CT CHERRY	No	No	No	No	No	Yes	Yes	
THE DEMON DELTA-8 GUMMIES	No	No	No	Yes	No	No	No	Unspecified ingredient: "bitter blockers"
LOUD CLOUD DELTA-8 GUMMIES	Yes	No	No	No	No	No	No	Label unclear, but does not appear to have prohibited ingredients
BLISS MELON GUMMIES	No	Unknown	No	Yes	No	No	No	

APPENDIX E: OPERATION CLEAN LEAF SAMPLE ORIGIN MAP

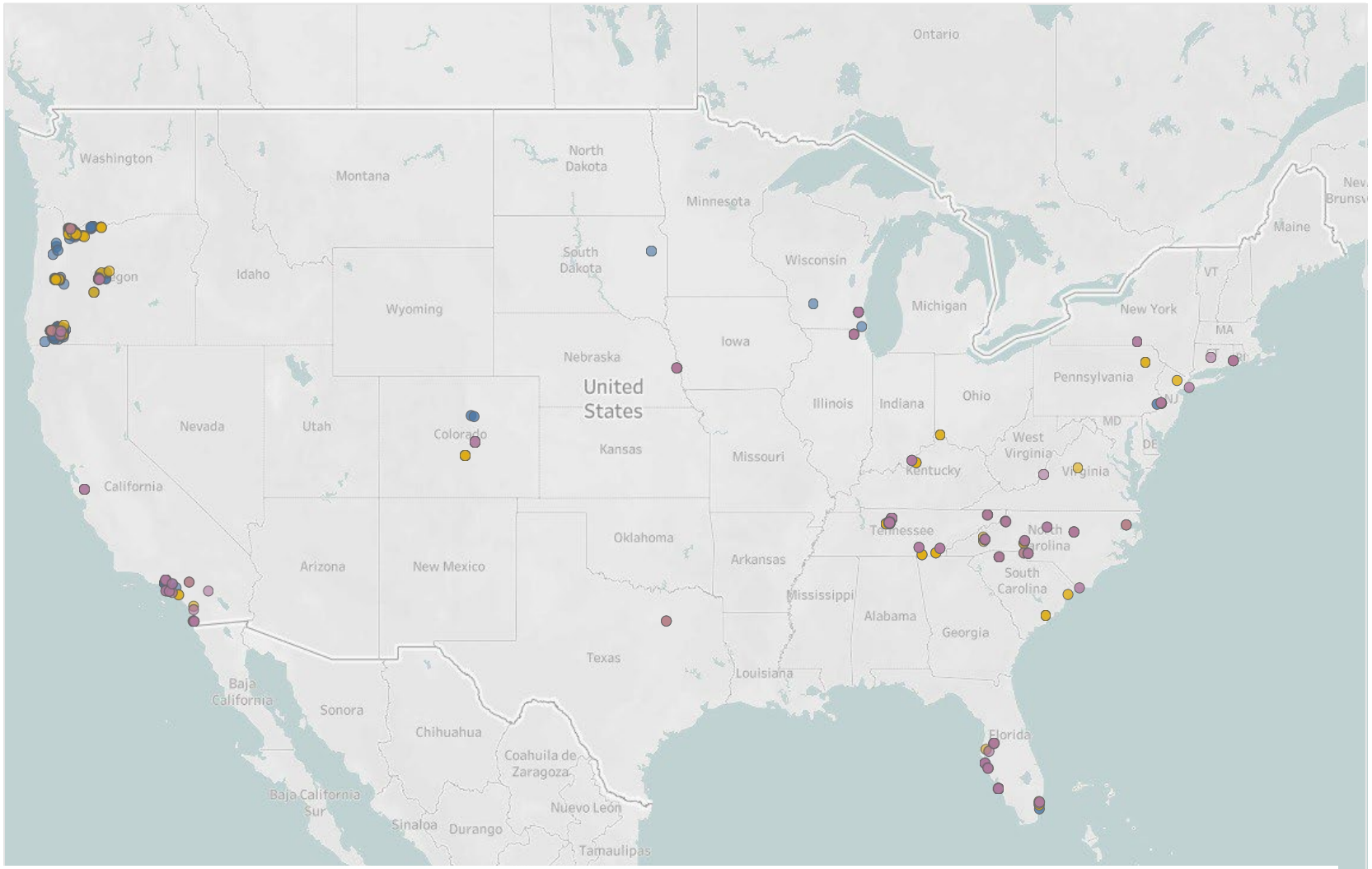

Figure 21. Map of latitude and longitude for the reported **shipping**, **ordering**, and **manufacturing** locations of cannabis samples collected for Operation Clean Leaf