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Cannabis Laboratory Accreditation Recommendations

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Cannabis Laboratory Accreditation Recommendations

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Executive Summary

In 2018, the Washington State Legislature directed the Washington State Department of Ecology (Ecology) to research and develop preliminary recommendations for protocols and accreditation standards for cannabis¹ testing laboratories, as stipulated in Engrossed Substitute Senate Bill 6032:

Section 302: For the Department of Ecology – Appropriations (FY 2019)

(17) \$98,000 of the dedicated marijuana account—state appropriation for fiscal year 2019 is provided solely for the department to begin conducting research into appropriate protocols and accreditation standards for marijuana testing laboratories. By January 15, 2019, the department must report to the appropriate committees of the legislature with preliminary recommendations regarding laboratory accreditation standards that should be applied to marijuana testing laboratories.

The legalization of cannabis use in Washington has resulted in the availability of a number of cannabis products throughout the state. To ensure that consumers have access to safe and properly labeled products, the Washington State Liquor and Cannabis Board and the Department of Health require products to be tested by an accredited laboratory. Washington cannabis labs are required to test medical and recreational products for:

- Pesticides (medical cannabis only)
- Heavy metals (medical cannabis only)
- Potency
- Moisture
- Water Activity
- Microbiology
- Foreign matter
- Residual solvents
- Mycotoxins

Accreditation is formal recognition of conformity to a standard. An accredited laboratory is capable of providing accurate and defensible data according to established laboratory quality standards. Accreditation requires evaluation of a laboratory’s quality system, staff, facilities and equipment, test methods, records, and reports (Ecology, 2010). The testing of cannabis products by accredited laboratories provides confidence that the products are properly evaluated, resulting in safe consumer products.

The Revised Code of Washington 69.50.345 charges Washington State Liquor and Cannabis Board (WSLCB), in consultation with Washington State Department of Health (DOH) and Washington State Department of Agriculture (WSDA), to establish accreditation requirements for cannabis testing laboratories. The WSLCB or its designee accredits cannabis testing laboratories according to Chapter 314-55 WAC. Currently, cannabis testing laboratories are evaluated by a private accreditation provider, RJ Lee, under contract with the WSLCB.

Evaluation of Current Cannabis Lab Accreditation Process

In response to this legislative directive in ESSB 6032, Ecology researched current accreditation practices in Washington and reviewed other states’ approaches. Ecology developed four

¹ The term “cannabis” is used throughout this document. “Marijuana” will be used in discussions where the referenced context requires this alternative term.

accreditation models that included feasible approaches and a no action/no change model. The following criteria were used to rank the models:

- 1) Does the model provide a plan for comprehensive accreditation?
- 2) Does the model provide essential technical assistance for both specific subjects and broad topics?

In our evaluation and ranking process, we found two main challenges:

- Current laboratory quality standards (methods, method validation protocols, and performance criteria) as outlined in Chapter 314-55 WAC are insufficient to support a robust, science-based cannabis laboratory accreditation program. Revisions are needed for analytical methods, method validation protocols, performance criteria, proficiency testing, and homogenization procedures.
- Widely accepted laboratory quality standards for testing cannabis and cannabis products do not yet exist.

We concluded that the legalization of cannabis presents a number of challenges that many states, including Washington, face. States primarily depend on federal laws and rules as a framework for their regulations. Cannabis has not been legalized at the federal level, so an overarching set of practices for cannabis labs does not exist. Because there are no federal regulations, a patchwork of processes and procedures for labs have been developed in different states. We found that gaps exist within the current accreditation program in Washington State, which may reduce confidence in product testing results and possibly compromise the health and safety of consumers.

Recommendations

To strengthen Washington's cannabis laboratory accreditation program, we recommend the following sequential actions:

- (1) Assemble a Cannabis Science Task Force consisting of experts in chemistry, microbiology, and food and agricultural testing methods, and include representatives from DOH, WSDA, WSLCB, and Ecology.
- (2) Establish new laboratory quality standards. The Cannabis Science Task Force would develop or adapt appropriate science-based analytical methods, method validation protocols, performance criteria, proficiency testing, and homogenization procedures for testing cannabis and cannabis products.
- (3) Adopt the new laboratory quality standards developed by the Cannabis Science Task Force. Because WSLCB has authority to set laboratory quality standards for cannabis testing laboratories, this step would require revisions by WSLCB to Chapter 314-55 WAC.
- (4) Maintain the current private accreditation provider until the new laboratory quality standards are in place.

(5) Lastly, designate Ecology's Laboratory Accreditation Unit (LAU) as the accreditation provider for Washington State cannabis testing laboratories. Laboratories would be evaluated using LAU's accreditation framework (Chapter 173-50 WAC) and revised cannabis-specific laboratory quality standards in Chapter 314-55 WAC. We recommend this approach because (1) Ecology's existing environmental and drinking water laboratory accreditation programs are successful models, and (2) Ecology's experienced staff can provide technical assistance to laboratories for essential quality assurance practices.

Based on our research and findings, multiple actions must take place to establish a robust and defensible cannabis laboratory accreditation program implemented by Ecology, or any other accrediting body. The primary challenge to developing an improved accreditation program for Washington State cannabis laboratories is the lack of established laboratory quality standards.

To develop appropriate laboratory quality standards, Ecology recommends formation of a Cannabis Science Task Force comprised of agencies and individuals with the needed expertise. The newly formed Cannabis Science Task Force should inform future WAC updates, which may require revision of language in at least nine WACs, as outlined in this report. The current accreditation process should remain intact while laboratory quality standards for cannabis testing laboratories are developed and WACs are revised.

Ecology estimates that the Cannabis Science Task Force would need 30 months to develop new laboratory quality standards, completed in January 2022. In the interim, the Task Force would identify early action priorities to improve laboratory testing by March 2020 and address these by December 2020. Rulemaking for the Washington Administrative Code updates identified in this document would take approximately 24 months from initial filing with the Washington State Code Reviser.

Finally, once laboratory quality standards are adopted into regulation, designate Ecology's LAU as the accreditation provider for Washington cannabis testing laboratories.

Estimated costs to implement Ecology's recommended approach

Ecology estimated costs for each of the four models evaluated in this report. The models range from the very simple to complex and span a period of 2 to 6 years for implementation. Estimates were based on the agency's best working knowledge at the time this report was published. Descriptions of each model along with estimated costs are included and begin on page 27 of this report.

The model recommended by Ecology was estimated at the following costs:

Model 1: \$2.5 million for the initial 6-year period with ongoing auditor costs of approximately \$363,000 per year thereafter.

Introduction

In 2018, the Washington State Legislature directed the Washington State Department of Ecology (Ecology) to research and develop preliminary recommendations for protocols and accreditation standards for cannabis testing laboratories, as stipulated in Engrossed Substitute Senate Bill 6032:

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The Revised Code of Washington 69.50.345 charges WSLCB, in consultation with DOH and WSDA, to establish accreditation requirements for cannabis testing laboratories. The WSLCB or its designee accredits cannabis testing laboratories according to Chapter 314-55 WAC.

Currently, cannabis testing laboratories are evaluated by a private accreditation provider under contract with the WSLCB. However, language within Chapter 314-55 WAC does not sufficiently detail cannabis-specific laboratory quality standards (methods, method validation protocols, and performance criteria) for laboratories to follow. Such laboratory quality standards are necessary for a robust, scientifically sound laboratory accreditation program.

Terminology and Agency Authority

Three terms are used frequently in this report: product standards, laboratory quality standards, and accreditation standards. These different standards work together to contribute to the quality of cannabis products.

Product standards are regulatory requirements that define the acceptable content of consumer products. Compliant products have specified compositions and are free of specified contaminants. Current cannabis product standards include potency levels, pesticides limits, mycotoxin limits, packaging requirements, and others. The WSLCB and DOH share the authority for setting these standards.

Laboratory quality standards are tests designed to evaluate a product's compliance with established product standards. In broad terms, laboratory quality standards are defined methods, method validation protocols, and performance criteria. These provide laboratories with widely accepted, standardized procedures, and they give accreditation providers critical elements to assess during the accreditation process. They are typically developed by federal agencies or consensus organizations. For cannabis, WSLCB has the authority to define laboratory quality standards in the Washington Administrative Code.

Accreditation standards are criteria to evaluate a laboratory's capability to provide accurate, defensible data. Accreditation standards at the system level include descriptions of authority (i.e., to grant, deny, suspend, and revoke accreditation), the accreditation certification cycle (e.g., 1-year

period), on-site audit frequencies, application process, fee structure, and other procedural specifics. Additionally, accreditation standards typically assess a lab’s ability to meet previously established product-specific laboratory quality standards. Some items evaluated include appropriate use of methods and standard operating procedures, use of quality control samples, and proficiency testing sample results. Currently, WSLCB sets the accreditation standards in Washington and contracts with a private accreditation provider.

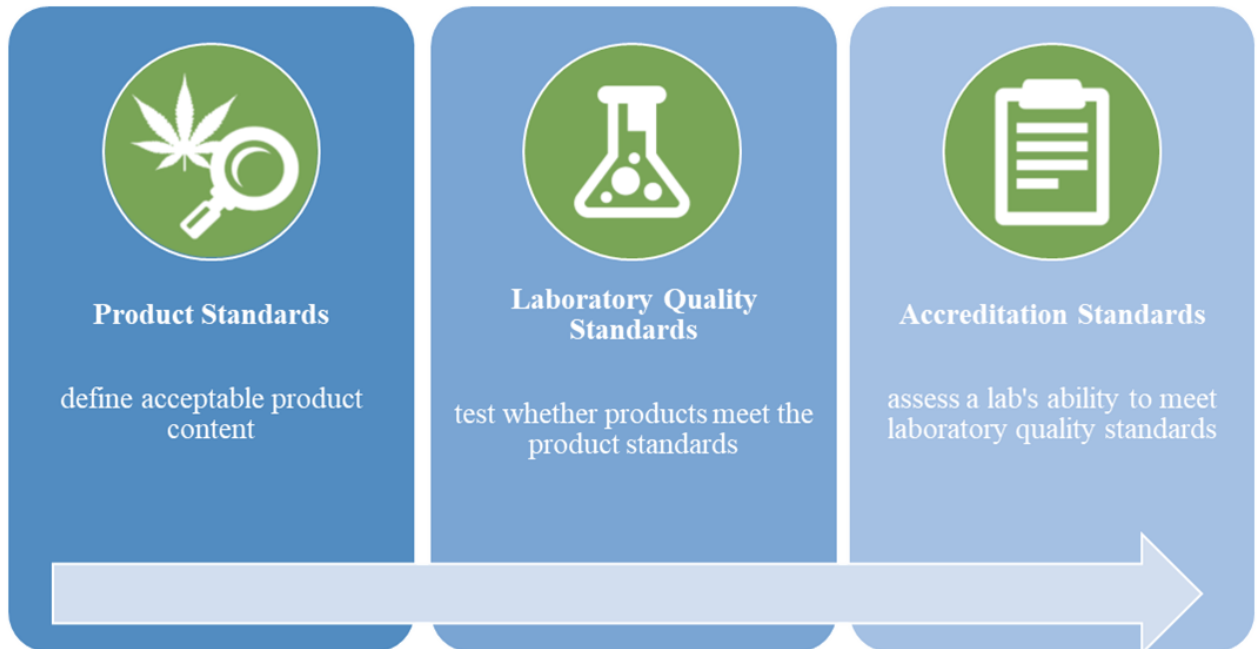


Figure 1. The relationship among product standards, laboratory quality standards, and accreditation standards.

Table 1. Terminology and current agency authority for cannabis regulation and laboratory accreditation in Washington.

	Product standards	Laboratory quality standards	Accreditation standards	Accreditation provider
Description	acceptable product content	approved methods, validation protocols, and performance criteria	items and process for evaluation of lab's ability to implement laboratory quality standards	independent body that evaluates a lab according to the accreditation standards
Current cannabis example	moisture content not more than 15%	moisture content test method (not available)	system-level audit (not sufficient)	Private contractor
Current agency authority	WSLCB and DOH	WSLCB	WSLCB, in consultation with DOH and WSDA	WSLCB

What is Laboratory Accreditation?

Accreditation is the formal recognition that a laboratory is *capable* of producing accurate and defensible analytical data. An accredited laboratory possesses the technical competence to perform an identified scope of work through specified procedures and methods to meet defined laboratory quality standards. Accreditation requires evaluation of a laboratory's quality system, staff, facilities and equipment, test methods, records, and reports (Ecology, 2010).

Accreditation assessments are performed by independent entities. These entities must be separate from the laboratories they accredit. They must also be independent from those who establish, set, or authorize the laboratory quality standards and methodologies. This arrangement is designed to instill confidence in the laboratories and their results through impartial evaluation of a pre-determined quality system.

Accreditation does *not* prescribe particular procedures, methods, or performance criteria. It ensures that the required methods and standards established by others are practiced and applied appropriately.

Accreditation does *not* designate product standards or laboratory quality standards. Rather, accreditation ensures that the standards are being met.

Accreditation alone does *not* eliminate the "human factor." It does *not* prevent laboratory personnel from performing short cuts, procedure deviations, and altering or forging measurements during daily use of an accredited method or procedure. Such human errors may be a result of intentional fraud, incompetence, or inadvertent error.

Accreditation does *not* mean that any specific report or set of data originating in an accredited lab is accurate or defensible (Ecology, 2010).

The Importance of Product Testing and Lab Accreditation

The cannabis products sold in Washington State must be tested to ensure that they are safe for use or consumption. WSLCB and DOH require that products be tested for:

- Pesticides (medical cannabis only)
- Heavy metals (medical cannabis only)
- Potency
- Moisture
- Water Activity
- Microbiology
- Foreign matter
- Residual solvents
- Mycotoxins

They also require that this testing be conducted by accredited laboratories. To gain accreditation, a laboratory must demonstrate that it is capable of conducting reliable tests and generating credible data. The testing of cannabis products by accredited laboratories provides confidence that the products are properly evaluated, resulting in safe consumer products.

The results and data coming from an accredited lab are important. For instance, if a product contains too much of a regulated contaminant, such as bacteria, then the product is not sold. Results for potency levels in cannabis products are important to ensure that consumers are informed about the dosage and labeling for the products they are purchasing.

The testing of cannabis products by accredited laboratories enhances confidence that safe and high-quality products are available to consumers.

Research

To comply with this legislative directive, Ecology gathered accreditation data, reviewed current Washington policies and practices, assessed policies and practices in other states, and developed preliminary recommendations.

The WSLCB, DOH, and WSDA provided information and data to support Ecology's research.

Most notably, Ecology obtained copies of comprehensive accreditation program records from the WSLCB-contracted accreditation provider, the RJ Lee Group. Records included initial application packages, lab-written standard operating procedures (SOPs), proficiency testing (PT) data, deficiency findings reports, and follow-up corrective action correspondence. Ecology used these records to assess the current accreditation process, review methods and protocols used by the cannabis testing laboratories, and identify challenges existing within the current cannabis testing system. Appendix A lists the laboratories for which Ecology obtained accreditation records.

To supplement our research, we investigated applied practices of organizations outside of Washington, including the following:

- Colorado Department of Public Health and Environment
- Maryland Medical Cannabis Commission
- New York Department of Health
- Oregon Health Authority and the Oregon Environmental Laboratory Accreditation Program
- Accreditation providers from non-governmental organizations
- Consensus standards organizations
- Proficiency testing sample providers

Additionally, our recommendations and discussions build upon some concepts originally delivered in the 2013 WSLCB-commissioned reports by BOTEC Analysis Corp.² The BOTEC papers presented a theoretical discussion of these concepts, while this report presents an observation-based synthesis.

² https://lcb.wa.gov/marijuana/botec_reports

Findings

Ecology's review of the current accreditation program, together with deeper evaluations of specific records and current procedures, revealed evidence of both real and potential areas of system failure. Therefore, the Ecology team examined cannabis laboratory accreditation from a comprehensive perspective. We identified critical challenges that would be a barrier for any accreditation system to succeed. The following discussion presents these challenges, and recommendations are provided. In Appendix B, we present some examples of other states' mitigations to similar challenges.

Current Laboratory Quality Standards Are Insufficient

Current quality standards as outlined in Chapter 314-55 WAC are insufficient to support a robust, science-based cannabis laboratory accreditation program. Revisions are needed for methods of analysis; method validation protocols; performance criteria; proficiency testing; and sample homogenization and preparation procedures.

The American Herbal Pharmacopoeia Monograph

According to WAC 314-55-0995,

Certified labs must follow the analytical requirements [in the] most current version of the *Cannabis Inflorescence and Leaf Monograph* published by the American Herbal Pharmacopoeia or notify the WSLCB or its designee what alternative scientifically valid testing methodology the lab is following for each quality assurance test.

However, the American Herbal Pharmacopoeia (AHP) monograph (Upton et al., 2014) is not a peer-reviewed, validated analytical method or compendium of said methods. Monographs exist as detailed written studies of a single specialized subject or an aspect of it, often by a single author and usually discussing a scholarly subject. Specifically, the cannabis AHP monograph provides a substantial discussion of the various botanical attributes and qualities of the cannabis plant and details topics such as best cultivation practices, history and use, and legality throughout the world. It presents a limited discussion of analytical approaches for identifying cannabis chemical constituents, both natural (e.g., cannabinoids) and from contamination (e.g., pesticides). However, this section does not explicitly detail analytical methods, require the use of any one validated method, or provide comprehensive analytical requirements to guide quality testing practices. The cannabinoids determination (potency) discussion covers nearly half of the 12-page analytical section. Also, it does not provide a comprehensive outline of analytical and critical quality assurance practices.³

There are some robust analytical methods referenced within the paper. These methods are suggested as *possible* for testing cannabis or cannabis products, based on their recognized effectiveness for testing other matrices. Examples include the U.S. Environmental Protection

³ Missing critical elements: method validation protocols, quality control sample requirements, and other performance criteria to judge the accuracy and reliability of generated data.

Agency (EPA) Residue Analytical Methods (RAM)⁴ for testing food commodity products, the Food and Drug Administration's (FDA) bacterial analytical manual (BAM),⁵ and the United Nations Office of Drugs and Crime (UNODC) method for the identification of cannabis through the analytical determination and presence of cannabinoids.⁶ However, in each case, the applicability of the analytical method is noted as likely *limited* due to the lack of empirical evidence that it is appropriate for testing cannabis or cannabis products. The document further attests that no single analytical method should be expected to test one chemical across all cannabis and cannabis product types.

Laboratory users of this document are left to design their own testing protocols, which may or may not be suitable for their intended use, and which may not generate accurate data.

The Good Laboratory Practice Checklist

Currently, the Good Laboratory Practice (GLP) Checklist contained in WAC 314-55-103 is used to certify cannabis testing labs. The auditors use this general checklist to evaluate laboratory operations, quality systems, and laboratory-developed methods designed around insufficient laboratory quality standards.

Specifically, for evaluations of testing methods, the auditors use the checklist to hold laboratories accountable for the criteria the laboratories themselves write into their standard operating procedures (SOPs). With insufficient Chapter 314-55 WAC laboratory quality standards, the laboratories are not required to implement methods with specific quality assurance (QA) and quality control (QC) measures to ensure that quality data can be generated. Thus, the laboratories are allowed to design their own levels of QA/QC to be accredited to and regulated against. Cannabis laboratories in Washington use different QA/QC measures, so accreditation is currently inconsistent among laboratories.

Proficiency Testing

Determination of a laboratory's capability to generate accurate and reliable data is challenging without augmentations to the current available proficiency testing (PT) system. WAC 314-55-1025 stipulates that the WSLCB or WSLCB's vendor is to determine the sufficiency of the proficiency tests. The WAC further states that the WSLCB can waive proficiency tests if PT samples or PT programs are not available. Proficiency test evaluations are an essential part of laboratory accreditation.

A proficiency test evaluation is a process where a known sample (PT sample) is provided for analysis, but the chemical constituents are unknown to the laboratory performing the analysis. Testing of PT samples provides laboratories unknown chemical constituents in a representative matrix. They are designed to ensure that there is appropriate implementation and use of laboratory methods. PT evaluation providers use results from all participating laboratories to establish and

⁴ <https://archive.epa.gov/pesticides/methods/rammethods/web/html/ram12b.html>

⁵ <https://www.fda.gov/Food/FoodScienceResearch/LaboratoryMethods/ucm2006949.htm>

⁶ https://www.unodc.org/documents/scientific/ST-NAR-40-Ebook_1.pdf

assess proficiency of each individual participant.

Participation in PT evaluations is required for pre-accreditation and ongoing assessments of competency for all major testing programs that support environmental and public health regulations. These include EPA environmental and drinking water testing programs,⁷ food and feed programs⁸ in the United States Department of Agriculture (USDA), and the Clinical Laboratory Improvement Amendments (CLIA) programs.⁹ For these well-established programs, a wide variety of material and matrix-specific PT samples are available. Proficiency test samples are available for drinking water, and for numerous types of wastes, soils, foods, feeds, pharmaceutical, geological, and mined materials. These PT evaluation samples may be obtainable from the organizations that established the consensus methods, by the regulatory oversight program, or by private for-profit companies.

Many other states' cannabis testing programs are confronted with the lack of appropriate PT samples. This widely known problem also exists in Washington State. For Washington cannabis testing laboratories, only two proficiency test providers^{10,11} are recognized. Both of these providers currently offer only "surrogate" or non-cannabis matrix matched PT samples in matrices such as hops, safflower oil, hemp oil, hemp bud, and solvent-based matrices. Further, these PT sample matrix selections do not cover the breadth of actual cannabis products types (e.g. foods, sodas, lotions) that require testing in Washington. In other words, the current available PT samples do not match the levels of constituent(s) (e.g., cannabinoids¹²), matrices, or complexities needed to replicate those observed in the products being tested on a daily basis. This renders them ineffective mechanisms to assess appropriate implementation and use of laboratory methods for all product and matrix types tested.

Specifically notable, pesticide detection and quantification in the presence of low or no concentrations of cannabinoids is drastically different from that of pesticides testing in the presence of cannabinoid interferences. Additionally, those provided in a solvent matrix are essentially "analytically ready" and thus do not follow the preparation path and handling of a real non-solvent matrix sample (i.e., homogenization and preparation steps).

It may be practical to establish round robin (interlaboratory) comparisons using cannabis and cannabis products. Under the current legal restrictions, the cannabis and cannabis products matrix materials for relevant PT samples would need to come from inside the state. This would be most suitable for assessing potency among the laboratories. Contaminant testing comparison studies

⁷ <http://www.nelac-institute.org/content/NEPTP/ptproviders.php>

⁸ https://www.aphl.org/programs/food_safety/laboratory-accreditation/Documents/Proficiency-Testing-Provider-List.pdf

⁹ United States Centers for Medicare and Medicaid CLIA PT providers: https://www.cms.gov/Regulations-and-Guidance/Legislation/CLIA/Proficiency_Testing_Providers.html

¹⁰ <http://nsi-es.com/proficiency-testing.aspx>

¹¹ <https://emeraldscientific.com/>

¹² Component containing DEA-restricted constituents.

would need to source one or more samples¹³ that contain appreciable levels of the regulated contaminants. Products containing contaminants may be difficult to obtain from within state stock. Implementation of interlaboratory round robins with state-sourced samples may provide a quick, low-cost interim solution while a comprehensive PT program is developed.

Alternatively, a state program or private company under advisement of the state might source products (within the state) and then spike cannabis and cannabis products with contaminants at various concentrations to replicate actual samples. Currently, Colorado implements a state-run PT program, and Oregon uses a private company to ensure all chemical (and contaminant) constituents are present.¹⁴

Sample Homogenization Procedures

Sample homogenization in the laboratory presents an additional challenge. Absence of guidance and detailed homogenization techniques will generate biased samples. Biased samples entering into an accredited analytical testing system results in biased reported results. As with analytical methods for testing cannabis, there are no nationally or internationally recognized standard methods for cannabis sample homogenization.

Sample homogenization procedures are defined at the discretion of the laboratory and may lack required protocols or mechanisms to ensure quality criteria. Inefficient and inadequate homogenization practices will lead to variable, non-representative lab testing results. Preparation and pre-preparation methods are not normally evaluated in accreditation activities, unless they are included in the analysis method or in a preparation standard operating procedure. These should be assessed as a part of accreditation activities, provided that there is an established procedure and set performance requirements.

¹³ For all defined appropriate product types, e.g., cannabis flower/trim, edible product(s), pharmaceuticals, inhalants, concentrates, and other intermediates.

¹⁴ For some PT program studies, PT samples may not cover all contaminants, because PT studies often purposely omit a few constituents as a part of the test design.

Widely Accepted Laboratory Quality Standards Do Not Exist

The challenge remains that nationally or internationally “recognized,” “standard,” or “approved” methods validated specifically for the preparation and analysis of cannabis and cannabis products largely do not exist. This is partially due to the infancy of the industry and patchy legal and policy frameworks. Also, the production of validated methods is a demanding undertaking.

In fact, production of validated methods usually requires many months to years of development, rounds of intralaboratory (single) and interlaboratory (multiple) validation studies, and method peer-review, even with established method development protocol, such as those employed by the EPA¹⁵ or the Association of Official Analytical Chemists (AOAC).¹⁶ Method development is further complicated with the need to test drastically differently structured product types, like those in the cannabis industry, such as foods, drinks, pharmaceuticals, and various plant materials, to name a few. Additionally, within each product type, there also may be multiple matrices needing further development of distinct matrix-specific protocols.

For both interim and long-term solutions, it may be practical to adopt (and adapt) analytical methods that are not currently recognized for use on cannabis. These may include approved methodologies used by the USDA or U.S. Food and Drug Administration (FDA) in other testing programs.¹⁷ Other regional cannabis-specific published methods from states,¹⁸ countries,¹⁹ instrument manufacturers, or by the industry itself may warrant further review for suitability to serve as approved methods. Adoption of federal government-authored methods, such as EPA methods, will not come with the same support or technical oversight as is available when they are practiced under their intended scope. Further performance criteria may need to be added to adopted methods to accommodate specific method applications.

Alternatively, it may be practical to adopt or adapt performance criteria or validation protocols from specific testing methods or programs, such as AOAC protocols, to be used in conjunction with non- standard or laboratory-created methods, such as those for determining potency.

Ecology asserts that although the testing laboratories have valuable expertise, experience, and information to contribute to the discussion, it should not be left to individual cannabis testing laboratories to determine the fundamental and essential critical items: most appropriate methods, method validation protocols, and method performance criteria. Those determinations should be made by regulators, in part to help instill public confidence in lab testing.

¹⁵ <https://www.epa.gov/measurements-modeling/method-validation-and-peer-review-policies-and-guidelines>

¹⁶ http://www.aoac.org/aoac_prod_imis/AOAC/Publications/Official_Methods_of_Analysis/AOAC_Member/Pubs/OMA/AOAC_Official_Methods_of_Analysis.aspx?hkey=5142c478-ab50-4856-8939-a7a491756f48

¹⁷ <https://www.fda.gov/Food/FoodScienceResearch/LaboratoryMethods/default.htm>

¹⁸ Or from within state, such as adopting methods already used within established agency programs (i.e., WSDA).

¹⁹ Methods and practices are anticipated from Canada, due to recent legalization of cannabis nationally.

Consensus Standards Used Elsewhere

Established consensus laboratory quality standards, methods, and method validation criteria are necessary to set the expectations and requirements of doing business to deliver a specific product, for example, cannabis testing for quality assurance.

Industry-specific member-based organizations such as The NELAC Institute (TNI), United States Pharmacopeia (USP),²⁰ the Association of Public Health Laboratories (APHL), ANSI, American Society for Testing Materials (ASTM),^{21,22} and International Union of Pure and Applied Chemistry (IUPAC)²³ generate standards and guidance for a wide range of disciplines using a proficient fundamental framework. Regardless of industry or practice, each organization's participating members donate their time and expertise collectively to drive the mission and objectives to help strengthen the practices, methods, and quality within their industry or discipline.

Generated consensus standards may facilitate government policy or may be developed out of a need to administer an activity to meet a set policy. In some cases, very specific methodologies, procedures, or practices must be developed to perform work to achieve required outputs or to meet policy. Where this is the case, methodologies, procedures, and practices are deliberately developed, practiced, perfected, validated, and peer-reviewed. Acceptance or adoption of these items is often contingent on issuance by governmental or authoritative bodies recognized as following best and appropriate science practices.

As an example, the EPA adopted The NELAC Institute (TNI) standards (2009) through implementation of the National Environmental Laboratory Accreditation Program (NELAP). TNI standards build upon International Organization for Standardization (ISO) concepts but are structured to facilitate best policy and practices and to harmonize accreditation specific for environmental analyses. The EPA has developed and validated a large volume of methods, but does also recognize methods developed by ASTM, AOAC, USGS, the American Water Works Association,²⁴ and a few others. NELAP-participating states administer laboratory accreditations to TNI standards, established program methods, and regulatory policy.

²⁰ Responsible for developing and disseminating public standards for medicines and other articles, and engaging in related public health programs. <http://www.usp.org/sites/default/files/usp/document/about/convention-membership/2015-2020-bylaws.pdf>.

²¹ <https://www.astm.org>

²² ASTM Committee D37 on Cannabis was formed in 2017 to develop standards for cannabis, its products, and processes: <https://www.astm.org/COMMITTEE/D37.htm>.

²³ <https://iupac.org/who-we-are/strategic-plan>.

²⁴ <https://www.awwa.org/store/productdetail.aspx?productid=28493774>

The ISO/IEC²⁵ 17025 Accreditation Standard Is Not Enough

The International Organization for Standardization (ISO) standards are developed through consensus by technical committees consisting of international members participating from 162 individual nations, including the United States. Participating members sit on technical committees that assist and guide in the development of international standards for processes, products, and personal certifications.

The ISO/IEC 17025²⁶ accreditation standard was developed by ISO in conjunction with the International Electrotechnical Commission (IEC). It presents the general requirements, specifications, and guidelines necessary to judge the competence of testing and calibration laboratories. The ISO/IEC 17025 standard builds upon the quality management system²⁷ assessment criteria and basic laboratory concepts. The ISO/IEC 17025 standard serves a broad array of laboratory disciplines by not incorporating explicit details that address any one specific industry's needs, such as application considerations, relevant technologies, or industry standards. Accreditation to the ISO/IEC 17025 standard alone does not distinguish a laboratory's capability to provide any particular laboratory services, such as a capability to test road materials versus cannabis products. An ISO /IEC 17025 accreditation remains general, unless it is paired with established specifications or policy and adoption of other regulatory, industry, or consensus standards.

ISO provides this guidance regarding the use and applicability of the ISO/IEC 17025 standard:

ISO/IEC 17025:2005 is for use by laboratories in developing their management system for quality, administrative and technical operations. Laboratory customers, regulatory authorities and accreditation bodies may also use it in confirming or recognizing the competence of laboratories. ISO/IEC 17025:2005 is not intended to be used as the basis for certification of laboratories. (ISO, 2005)

Several states are currently using an ILAC MRA provider of ISO/IEC 17025 accreditation for cannabis. There are reasons why this may work for other states, but it is currently not a good fit for Washington. In general, ISO/IEC 17025 accreditation may be more appropriate in states that 1) have clear, defined laboratory quality standards, 2) have in-house or in-state vendor-provided proficiency testing programs, and 3) have health and science-based agency oversight. For instance, the Massachusetts Medical Use of Marijuana Program requires independent testing laboratories to obtain an accreditation to ISO/IEC 17025. The Medical Use of Marijuana Program, housed within the Massachusetts Department of Public Health, provides several guidance documents and testing protocols for the independent testing laboratories to follow. These include a 128-page comprehensive Quality Assurance Program Plan for Analytical Testing Laboratories²⁸ that covers

²⁵ International Organization for Standardization/International Electrotechnical Commission

²⁶ ISO/IEC 17025:2005 is the current recognized standard edition. In December of 2017 the ISO/IEC 17025:2017 edition was published as an update to the 2005 version. Conformity assessment bodies and testing laboratories are required to transition to the newer version by December 2020. (International Organization for Standardization)

²⁷ ISO 9001 Quality Management Systems – Requirements. International Standards Organization. Fifth edition. 9- 15- 2015.

²⁸ <https://www.mass.gov/files/documents/2018/05/29/quality-assurance-program-plan.pdf>

everything from quality management systems to guidance for sampling, analysis-and instrument-specific QA/QC requirements, performance criteria, method validation protocols, and data review requirements.

While ISO/IEC 17025 is not currently a good fit for Washington, with defined quality standards, a robust proficiency testing program, and auditors with appropriate expertise to provide technical assistance, ISO/IEC17025 could be an option.

Concerns Outside the Purview of Accreditation

Cannabis Sampling

The current WSLCB rule describes a basic process for cannabis sampling that permits the licensed producer or processor to collect samples for laboratory analysis (WAC 314-55-101). Because it occurs outside the laboratory, sampling is not evaluated in a laboratory accreditation program. Accreditation assessments are restricted to laboratory processes and activities performed by laboratory personnel.

Untrained samplers may lack the technical knowledge to collect representative, consistent samples without introducing error and bias into collected samples. Bias introduced at sample collection persists through all stages of preparation and analysis, resulting in the generation of biased data. Protocols should comprehensively describe approved sampling procedures, including matrix- or product-specific sampling approaches, use of sampling devices, and QA/QC.

Laboratory Fraud

Unfortunately, accreditation alone does not eliminate the possibility of intentional fraud. Laboratory personnel might deviate from procedures or alter or forge measurements during daily use of an accredited method or procedure. Such errors may be a result of intentional fraud, incompetence, or inadvertent error. An investigations division is needed to detect and prevent sample adulteration and laboratory fraud.

Accreditation Providers

Ecology's Laboratory Accreditation Unit

Within Ecology there is a small team of scientists that functions in a specialized role as laboratory accreditation specialists. Ecology's Laboratory Accreditation Unit (LAU) is made up of three chemists, a microbiologist, a toxicologist, and an environmental specialist. The unit implements the Washington State Environmental Laboratory Accreditation Program established under provisions of RCW 43.21A.230²⁹ and satisfies the intent of RCW 43.20.050.³⁰

Ecology's LAU accredits to Chapter 173-50 WAC, *Accreditation of Environmental Laboratories*.³¹

²⁹ <http://app.leg.wa.gov/RCW/default.aspx?cite=43.21A.230>

³⁰ <http://app.leg.wa.gov/RCW/default.aspx?cite=43.20.050>

³¹ <http://apps.leg.wa.gov/WAC/default.aspx?cite=173-50>

The WAC in itself does not require environmental laboratories to be accredited; those requirements are specified in other state, federal, or regulatory rules. In 2002, the WAC scope was broadened when Ecology assumed the responsibility of certification of drinking water laboratories to fulfill the federal Safe Drinking Water Act (SDWA) laboratory certifications requirements. A Memorandum of Understanding (MOU) was established by the DOH and Ecology, moving authority to administer accreditation activities to Ecology. The MOU further stipulates that all certifications, decertifications, and provisional certifications taken upon a laboratory shall be the responsibility of Ecology (DOH, 2002).

LAU's program administers both initial accreditations and continuing accreditations for a broad range of categories, including general chemistry, trace metals, organics, microbiology, and toxicology. The first step to any accreditation is submission of a completed application³² to LAU. The application is reviewed to assess the complexity of the laboratory and assign appropriate accreditation activities and their associated fees. At that time, the laboratory must also submit its quality assurance (QA) manual or any changes to an existing QA manual. The QA manual is where a laboratory outlines its policies, organization, objectives, functional activities, and QA and quality control (QC) activities designed to achieve its quality goals. Drinking water laboratories must meet additional drinking water QA plan requirements. An approved QA manual is one by which the laboratory adequately documents its plan to ensure that quality results are generated and reported.

LAU accreditations are to the parameter, or a combination of an analyte and an analytical method, for a specific matrix.³³ Laboratory-generated standard operating procedures (SOPs) are required for all the specific tasks the laboratory implements for each parameter. Some methods (SOPs) can encompass multiple analytes (and/or matrices), for instance, more than one metal by a single determinative analytical method. The scope, applicability, and level of modification, if any, that can be made by an end user to a method is defined within the cited original method. For environmental and drinking water laboratories, accredited parameter SOPs are to be generated from approved pre-established published methods.^{34,35} Some methods, such as EPA drinking water methods, are prescriptive, and modifications are not permitted. LAU performs SOP document reviews to assess deviations from cited methods and to look for calculation errors and other mistakes.

For accreditation, a laboratory's procedures are assessed through review of SOPs, along with data packages displaying initial demonstrations of capabilities (IDCs) and method detection limits (MDLs) or lower limits of quantitation (LLOQs). For continuing accreditations, example client data packages are additionally reviewed to evaluate whether the generated data is reported accurately and appropriately.

Deeper reviews into a laboratory's practices may occur at various stages during accreditation activities. This may include looking further into a laboratory's QA/QC practices to ensure data

³² <https://fortress.wa.gov/ecy/publications/SummaryPages/ECY07004.html>

³³ Official scopes of accreditation granted under four matrices: 1) drinking water, 2) non-potable water, 3) solids and chemical materials, and 4) air and emissions.

³⁴ <https://www.epa.gov/sites/production/files/2015-03/documents/testmeth.pdf>

³⁵ Use of alternate methods limited; requiring scrutiny by client, oversight program and/or EPA.

quality, such as the appropriate implementation of QC samples, calibrations, control charts, corrective action processes, data management, and record keeping. Other scrutiny may be warranted out of review of unexpected or incomplete data generated within the IDCs, MDLs, or LLOQs. Discussions surrounding a laboratory's use of validation techniques to develop a procedure (and SOP) may be necessary to ensure that all method performance characteristics (such as determinations of selectivity, sensitivity, linearity, reproducibility, robustness, and precision and bias) are addressed. Some discussions are requested by laboratories themselves, sometimes outside of accreditation activities, where LAU may be able to provide technical assistance, troubleshooting, or QA training opportunities for the laboratories.

Passing proficiency test (PT) results are mandatory to satisfy laboratory accreditation requirements. One recent set of PT results are required for each applicable parameter during the initial application process. Two PT studies must be completed each accreditation year thereafter, with the exception of microbiological and bioassay parameters, where only one PT study is required. Proficiency test samples must be acquired from an approved PT provider.³⁶

The final requirement for accreditation is an on-site audit to determine if a laboratory is capable of producing accurate and defensible data. On-site audits are required at initial accreditations and used as a tool for periodic assessment for maintaining accreditation. The auditor reviews and verifies the accuracy of the information provided in the QA manual and further reviews documentation and other evidence, including personnel training and experience, facility features, sample handling procedures, QA/QC procedures, analytical procedures, and data management practices. Audits may take one or more days, depending on the required scope of accreditation. Audit reports are issued following the audit. The report describes findings and actions required in response, and as appropriate, makes recommendations about resolutions of findings (Ecology, 2010). Reconciliation of identified deficient or negative findings is necessary to attain accreditation.

For the laboratories participating in the Washington State Environmental Laboratory Accreditation Program, LAU holds authority to grant, revoke, or suspend accreditations. Additionally, LAU has mechanisms in place to provide interim and provisional accreditation for certain circumstances. LAU may further recognize other accrediting authority of an environmental laboratory located in Washington or out-of-state.

Other Accreditation Providers

In the United States, there are eight recognized accreditation providers of the ISO/IEC 17025 accreditation standard. They are signatories to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA); the ILAC is an impartial organization that operates in conformance to the ISO/IEC 17011 standard.³⁷ Although they each operate and do business separately, the eight ILAC MRA members jointly agree to facilitate ISO accreditations with a mutually agreed standard process for consistency. ILAC MRA accreditation

³⁶ <https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Laboratory-Accreditation/Proficiency-testing-providers>

³⁷ ISO/IEC 17011: Conformity assessment – Requirements for accreditation bodies accrediting conformity assessment bodies.

bodies currently provide ISO 17025 certification services to both non-governmental and governmental organizations under various laboratory disciplines. Four of the eight ILAC MRA accreditation bodies are likely to provide services for accreditation of ISO/IEC 17025 for the cannabis industry in Washington State:

- American Association of Laboratory Accreditation (A2LA),³⁸ a nonprofit public membership society.
- ANSI-ASQ National Accreditation Board (ANAB).³⁹ ANAB is a non-governmental organization that provides accreditation services to public- and private-sector organizations and is jointly owned by the American National Standards Institute (ANSI) and the American Society for Quality (ASQ). ANSI serves as the official U.S. representative and participating member of ISO.
- International Accreditation Service (IAS),⁴⁰ a nonprofit, public-benefit corporation.
- Perry Johnson Laboratory Accreditation (PJLA),⁴¹ a privately owned organization.

³⁸ <http://www.a2la.org/>

³⁹ <https://www.anab.org/>

⁴⁰ <https://www.iasonline.org/services/>

⁴¹ <http://www.pjllabs.com/>

Washington State Agencies as Laboratory Science Resources

Washington State Department of Agriculture

The WSDA Chemical and Hop Laboratory currently operates as an established program to support investigations of alleged pesticide misuse, monitor pesticide residues in foods, carry out physical grading and chemical analysis of hops, and validate that accurate labeling is implemented for fertilizers. This laboratory ultimately supports USDA, EPA, and FDA regulatory requirements.

In August 2016, the WSLCB and WSDA entered into an interagency agreement (IAA) for the WSDA to develop methods and conduct testing for pesticide residues in cannabis and cannabis concentrates.

For cannabis, the WSDA adapted United States Department of Agriculture (USDA)–recognized methods (Anastassiades et. al, 2003; FDA, 1999, 2002) and validated those methods using USDA Pesticide Data Program (PDP) practices and guidelines (USDA, 2018).⁴² Drawing from their experience in testing pesticides in other crop plants, the WSDA developed two analytical procedures, each utilizing a separate analytical instrument,⁴³ to encompass a comprehensive list of pesticides. Additionally, the WSDA developed two mill-processing procedures for sample homogenization and one cannabis sample preparation procedure to use in conjunction with their analytical procedures.

Collectively the two WSDA analytical pesticide procedures are capable of screening for more than 200 pesticides in cannabis and cannabis concentrates, including a range of pesticides not permitted for use on cannabis crops and pesticides recognized as having a high potential of misuse. This includes the current WAC 314-55-108 action limit list of 59 pesticides, as well as pyrethrins and piperonyl butoxide.

In May 2017, the WSDA received an ISO/IEC 17025 accreditation through A2LA. This accreditation included A2LA’s Food Testing Program Requirements. These additional requirements contain the 2015 *AOAC International Guidelines for Laboratories Performing Microbiological and Chemical Analyses of Food, Dietary Supplements, and Pharmaceuticals*, which are required by agricultural and food safety regulating authorities. The issued certificate shows the WSDA lab as accredited for three methods to test pesticides, two combustion test methods, and one spectroscopy method. The certificate identifies only one accredited pesticide method as for use with “cannabis and other matrixes.” Individual pesticides are not specifically listed in their certification.

The WSDA also developed a cannabis potency procedure based on the AHP monograph. This method was also validated using the USDA Pesticide Data Program practice and guidelines, similar to the process used to validate their cannabis pesticide procedures. The potency procedure is not

⁴² USDA Pesticide Data Program’s *Chemical Compounds, PDP Commodity Grouping, Method Validation and Quality Control* guidance does not include cannabis in its scope because is not recognized federally as a commodity (USDA 2017).

⁴³ One procedure calls for a gas chromatography tandem mass spectrometer (GC-MS/MS) and the other a liquid chromatography tandem mass spectrometer (LC-MS/MS).

currently being implemented and is not included in the scope of their current ISO/IEC 17025 accreditation issued in 2017. Their current accreditation runs through July 2019.

Additionally, the WSDA runs a Food Safety and Consumer Services (FSCS) Laboratory. The FSCS implements several programs with grants from the FDA, including but not limited to the Food Emergency Response Network (FERN) and Manufactured Food Regulatory Program Standards (MFRPS).⁴⁴

Collectively the WSDA FSCS runs four laboratory divisions, currently testing milk, milk products, ready- to-eat products such as salads and sandwiches, and other deli items for pathogens, including *Escherichia coli* (*E. coli*) and *Salmonella*. They also test for water activity.⁴⁵ Grains and other commodities are analyzed for aflatoxins and other mycotoxins under the WSDA's Animal Feed Program. These pathogens and toxins are currently required for testing in cannabis and cannabis intermediate products.

The FSCS Laboratories are ISO/IEC 17025–accredited and follow the MFRPS, Association of American Feed Control Officials (AAFCO) Quality Assurance/Quality Control guidelines for Feed Laboratories,⁴⁶ and AOAC methodologies.

Washington State Department of Health

The DOH does not currently test any cannabis or cannabis products, including edibles or other products designed for a medical use.

The DOH operates its own laboratories, collectively known as Public Health Laboratories (PHL). These laboratories provide public health testing⁴⁷ for chemistry parameters,⁴⁸ shellfish biotoxins, radiochemicals, and food microbiology. Public Health Laboratories chemists and microbiologists also provide newborn screening and public health microbiology, including enteric pathogens, mycobacteriology, parasitology, and virology, to meet a wide array of public health testing objectives. As with the WSDA, the PHL also participates in FERN, as well as USDA and FDA food safety programs, using AOAC and FDA analytical methods.

The PHL holds seven separate certifications to cover the breadth of their testing capabilities, including a CLIA certification, FDA certificate for food and shellfish, and a Washington State accreditation for copper and lead in drinking water issued by Ecology's LAU.

⁴⁴ <https://www.fda.gov/Food/NewsEvents/ConstituentUpdates/ucm523145.htm>

⁴⁵ *E. coli*, *Salmonella*, and water activity also exist as required tests for cannabis and cannabis products.

⁴⁶ <https://www.aafco.org/Publications/QA-QC-Guidelines-for-Feed-Laboratories>

⁴⁷ <https://www.doh.wa.gov/Portals/1/Documents/Pubs/301-016-PHLDirectoryServices.pdf>

⁴⁸ Not currently providing production testing for inorganic chemistry parameters (as of August 2018).

Cannabis Laboratory Accreditation Models Evaluated

Ecology evaluated four potential scenarios for cannabis accreditation. We recommend the first model (Model One) as the best for development of a defensible cannabis accreditation program in Washington. The other models were examined, but we do not recommend them.

Criteria for Evaluating Models

Ecology compiled a broad list of accreditation options that included ideal approaches, realistic scenarios, and a no action/no change option. The broad list was narrowed down to three realistic and feasible scenarios to scope and analyze further, plus the no action/no change option. Under this fourth option, no changes to the current accreditation program would be required, with the exception of changing the accreditation provider. These “options” were renamed “models” when the key elements of each were finalized for presentation in this report.

The following criteria were used to rank the models:

- 1) Does the model provide a plan for comprehensive accreditation?
- 2) Does the model provide essential technical assistance for both specific subjects and broad topics?

For criterion 1, we assessed each accreditation model, looking at requirements and processes of the accreditation activity. For example, does the accreditation process require laboratories to have a quality assurance manual? Does it provide a review of standard operating procedures? Does it require demonstration capability reviews? Is successful completion of proficiency testing samples a requirement for laboratories to be granted accreditation?

For criterion 2, we assessed the level of technical assistance provided for analytical methods applicability, development of appropriate standard operating procedures, and training on fundamental principles or laboratory quality assurance practices.

These criteria were selected with the primary goal of increasing the likelihood that cannabis testing laboratories would have the necessary practices and procedures in place to produce accurate data and meet regulatory standards.

The ability of the model to provide a comprehensive accreditation is critical to achieving this goal. For instance, an accreditation based on assessments of specific product types (matrices, e.g., flower) for a specific contaminant (analyte, e.g., glyphosate) by specific testing method, collectively termed parameter, is more comprehensive than an accreditation not distinguishing or requiring assessment by parameter. The latter assumes that all product types or analytes can be tested without regard for their individual characteristics. But in fact, different testing methods may be needed for a food product versus a flower versus a topical lotion. Likewise, individual pesticides generally cannot be evaluated with identical methods.

The ability of the model to provide a high level of technical assistance was identified as essential. From a thorough review of laboratory accreditation documents, there is clear evidence that most laboratories are struggling with some fundamentals of basic laboratory practices and, notably, in

establishing and following appropriate quality assurance. Development of complex analytical techniques by an inexperienced laboratory with inexperienced personnel requires a substantial level of expert subject-matter technical assistance.

Model One (Ecology's recommended approach)

Ecology's Laboratory Accreditation Unit (LAU) assumes the regulatory role of accreditation provider. Laboratories are evaluated using LAU's accreditation framework (Chapter 173-50 WAC) and revised cannabis-specific laboratory quality standards in Chapter 314-55 WAC.

This model is our recommended approach. Ecology's LAU currently accredits over 450 environmental and drinking water laboratories in Washington. Our staff have decades of experience in evaluating laboratories and supporting them with reliable technical assistance.

This model requires the establishment of a Cannabis Science Task Force (Task Force) to collaborate on development of science-based laboratory quality standards (methods, method validation protocols, and performance criteria). The Task Force should advise WSLCB regarding WAC updates to ensure a robust, scientifically sound laboratory accreditation program.

This model requires revisions by WSLCB to language in the following WACs:

- Laboratory certification and accreditation requirements (WAC 314-55-0995)
- Quality assurance sampling protocols (WAC 314-55-101)
- Quality assurance testing (WAC 314-55-102)
- Proficiency testing (WAC 314-55-1025)
- Good Laboratory Practice Checklist (removal of WAC 314-55-103)
- Laboratory certification – Suspension and revocation (WAC 314-55-1035)

This model *may* require revision by WSLCB to language in the following WACs:

- Marijuana product compliance (WAC 314-55-107 and sections within Chapter 246-70 WAC)
- Pesticide action levels (WAC 314-55-108)

Advantages

- ✓ Ecology's staff is well versed in the use of LAU's accreditation framework.
- ✓ Minimal procedural changes to the LAU framework are projected. Thus, LAU accreditation can be implemented quickly once laboratory quality standards are set.
- ✓ LAU auditors are capable of providing additional technical assistance to laboratories for fundamental quality assurance practices.
- ✓ LAU auditors will have the subject-matter expertise for evaluation of cannabis-specific

laboratory work (e.g., organic chemists, microbiologists, etc.).

- ✓ Detailed audits will include rigorous review of methods, method validation, and performance criteria.
- ✓ Increases public confidence that labs are producing credible, unbiased data.
- ✓ Increases public confidence that product potency is as labeled and products do not contain contaminants.
- ✓ The Cannabis Science Task Force will develop science-based laboratory quality standards.

Disadvantages

- ✗ WAC content revisions require further identification, research, and adoption of scientific principles and practices. This process may be slow and challenging.
- ✗ A significant investment of state resources will be needed for multi-agency coordination (including WSLCB, DOH, WSDA, and Ecology).
- ✗ Cannabis testing laboratories will need to adapt to a new style of accreditation.

Estimated Costs for Model One

Ecology estimates that costs to implement Model One would be approximately \$2.5 million over a 6-year period. Thereafter, ongoing costs to run the accreditation program are estimated to be approximately \$363,000 per year.

Model Two (evaluated but not recommended)

An International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Agreement (MRA) accreditation provider accredits to an ISO/IEC 17025 accreditation and the revised cannabis-specific laboratory quality standards in Chapter 314-55 WAC.

This model requires the establishment of a Cannabis Science Task Force to collaborate on development of science-based laboratory quality standards (methods, method validation protocols, and performance criteria). The Task Force should advise WSLCB regarding WAC updates to ensure a robust, scientifically sound laboratory accreditation program.

This model requires revisions by WSLCB to language in the following WACs:

- Laboratory certification and accreditation requirements (WAC 314-55-0995)
- Quality assurance sampling protocols (WAC 314-55-101)
- Quality assurance testing (WAC 314-55-102)
- Proficiency testing (WAC 314-55-1025)
- Good Laboratory Practice Checklist (removal of WAC 314-55-103)
- Laboratory certification – Suspension and revocation (WAC 314-55-1035)

This model *may* require revision by WSLCB to language in the following WACs:

- Marijuana product compliance (WAC 314-55-107 and sections within Chapter 246-70 WAC)
- Pesticide action levels (WAC 314-55-108)

In addition, this model:

- Requires utilization of one identified ILAC MRA provider.
- May require collaboration with the ILAC MRA provider to ensure accreditation meets Washington's revised WAC requirements (dependent on provider's level of customizable services).

Advantages

- ✓ Fulfills industry desire for an ISO accreditation.
- ✓ This widely recognized international standard has good name recognition. It may increase public confidence that labs are producing credible, unbiased data, and thus increase public confidence that product potency is as labeled and products do not contain contaminants.
- ✓ Laboratories can market that their accreditation is to the internationally known ISO name.

- ✓ The Cannabis Science Task Force will develop science-based laboratory quality standards.

Disadvantages

- ✗ ISO accreditation uses broad, general systems audits, which may not include detailed review of methods, method validation, and performance criteria.
- ✗ Auditors may not have the subject-matter expertise for evaluation of cannabis-specific laboratory work (e.g., organic chemists, microbiologists, etc.).
- ✗ Accreditation provider may lack ability to provide technical oversight and assistance for laboratories.
- ✗ Costs are expected to increase with ISO accreditation.
- ✗ WAC content revisions require further identification, research, and adoption of scientific principles and practices. This process may be slow and challenging.
- ✗ A significant investment of state resources will be needed for multi-agency coordination (including WSLCB, DOH, WSDA, and Ecology).
- ✗ Cannabis testing laboratories will need to adapt to a new style of accreditation.

Estimated Costs for Model Two

Ecology estimates that costs to implement Model Two would be approximately \$1.4 million over a 6-year period.

Model Three (evaluated but not recommended)

Ecology's LAU assumes the role as the accreditation body and accredits cannabis testing laboratories to a revised version of the Good Laboratory Practice (GLP) Checklist (WAC 314-55-103) and revised laboratory certification and accreditation requirements (WAC 314-55-0995), at a minimum.

This model requires the establishment of a Cannabis Science Task Force to collaborate on updating the GLP Checklist. The Task Force should also consult on science-based laboratory quality standards (methods, method validation protocols, and performance criteria). The Task Force should advise WSLCB regarding future WAC updates to ensure a robust, scientifically sound laboratory accreditation program.

This model requires revision by WSLCB to language in the following WACs:

- GLP Checklist (WAC 314-55-103)
- Laboratory certification and accreditation requirements (WAC 314-55-0995)

This model *may* require revision by WSLCB to language in the following WACs:

- Quality assurance sampling protocols (WAC 314-55-101)
- Proficiency testing (WAC 314-55-1025)
- Laboratory certification – Suspension and revocation (WAC 314-55-1035)
- Pesticide action levels (WAC 314-55-108)
- Marijuana product compliance (WAC 314-55-107 and sections within Chapter 246-70 WAC)

Advantages

- ✓ Possible interim option.
- ✓ Best option to move towards Model One.
- ✓ Revisions to checklist may help to reconcile perceived and actual data quality issues.
- ✓ Cannabis laboratories are already accustomed to accreditation to the GLP checklist.
- ✓ Eventually, the Cannabis Science Task Force will develop science-based laboratory quality standards.

Disadvantages

- ✗ Interim accreditation to the revised GLP checklist will not sufficiently overcome the lack of established laboratory quality standards (methods, validation protocols and performance criteria).

- ✘ Significant investment of state resources will be needed for multi-agency coordination (including WSLCB, DOH, WSDA, and Ecology).
- ✘ Does not increase public confidence that labs are producing credible, unbiased data.
- ✘ Does not increase public confidence that product potency is as labeled or that products do not contain contaminants.
- ✘ Not a long-term solution.
- ✘ Challenging for LAU to accredit to insufficient laboratory quality standards.

Estimated Costs for Model Three

Ecology estimates that costs to implement Model Three would be approximately \$1.8 million over a 6-year period. Thereafter, ongoing costs to run the accreditation program are estimated to be approximately \$363,000 per year.

Model Four (evaluated but not recommended)

Ecology's LAU assumes the role of the accreditation provider, and cannabis testing laboratories are evaluated using LAU's accreditation framework (Chapter 173-50 WAC) and the current "as is" Good Laboratory Practice Checklist in WAC 314-55-103.

Advantages

- ✓ Lower implementation costs.
- ✓ Little or no rulemaking.
- ✓ Quickest to implement.

Disadvantages

- ✗ Accreditation program remains insufficient due to the lack of cannabis-specific laboratory quality standards (methods, validation protocols and performance criteria).
- ✗ Does not increase public confidence that labs are producing credible, unbiased data.
- ✗ Does not increase public confidence that product potency is as labeled or that products do not contain select contaminants.
- ✗ Does not provide a mechanism to correct all perceived and actual data quality issues.
- ✗ Not a long-term solution.
- ✗ Challenging for LAU to accredit to insufficient standards.
- ✗ Maintains status quo that testing labs do not want.

Estimated Costs for Model Four

Ecology estimates that costs to implement Model Four would be approximately \$363,000 per year and each year thereafter.

Recommendations

The primary challenge to developing a solid accreditation program for Washington State is lack of established laboratory quality standards. To strengthen Washington's cannabis laboratory accreditation program, we recommend the following five actions.

(1) Form a Cannabis Science Task Force.

Assemble a Cannabis Science Task Force (Task Force) to collaborate on the development of appropriate laboratory quality standards. The Cannabis Science Task Force should be composed of chemists, microbiologists, and toxicologists, and include those with expertise in public health and food and agricultural testing methods. The Task Force should include representatives from the DOH, WSDA, WSLCB, and Ecology. We also recommend the inclusion of cannabis industry non-governmental scientists. The level of non-governmental scientist participation would be based on Task Force mission and scope.

Task Force Composition

The initial Task Force workgroups should be led by one full-time staff from the Department of Agriculture and one from the Department of Ecology, both with expertise in analytical chemistry. Additional members should include those with chemistry, microbiology, and toxicology expertise. The Task Force should be composed of the following work groups:

- Laboratory Quality Standards Work Group:
 - **Lead** – Department of Agriculture
- Proficiency Testing Program Work Group:
 - **Lead** – Ecology

By March 2020 the Task Force should identify early action priority items that can be addressed by December 2020. The Task Force will report to the legislature in December 2020 on interim solutions for high priority items impacting cannabis testing. These early action items may include an interim plan to provide matrix-specific proficiency testing samples, sourced from within the state, to the cannabis testing laboratories, and development of laboratory quality standards around potency testing.

The Task Force may create additional advisory work groups to address concerns outside the purview of laboratory accreditation. For example, work groups could make recommendations regarding pre-laboratory cannabis sampling protocols, action limits, traceability reporting, and laboratory fraud. The Task Force should provide information for WAC revisions to WSLCB and DOH.

(2) Develop appropriate laboratory quality standards.

Laboratory quality standards should include determination and establishment of appropriate

methods for sample preparation and analysis; method validation protocols; and method performance criteria specific to the established methods.

The Cannabis Science Task Force should collaborate on development of appropriate laboratory quality standards. The Task Force would provide science-based recommendations to update language in the WAC sections regarding quality assurance (QA), homogenization protocols, QA testing, proficiency testing, good laboratory practices, action limits, and product compliance specifications with relevant and appropriate scientific practices. Functions of this Task Force should include, but not be limited to:

- Defining appropriate applicable methods (approved methods).
- Adopting or establishing method validation protocols.
- Defining performance criteria.
- Assessing appropriateness of emerging testing methods developed by other states, countries, or recognized consensus bodies.
- Advancing an in-state proficiency testing program.

(3) Adopt the new laboratory quality standards developed by the Cannabis Science Task Force.

New laboratory quality standards will require revisions by WSLCB to language in the following WACs:

- Laboratory certification and accreditation requirements (WAC 314-55-0995)
- Quality assurance sampling protocols (WAC 314-55-101)
- Quality assurance testing (WAC 314-55-102)
- Proficiency testing (WAC 314-55-1025)
- Good Laboratory Practice Checklist (removal of WAC 314-55-103)
- Laboratory certification – Suspension and revocation (WAC 314-55-1035)

This model *may* require revision by WSLCB to language in the following WACs:

- Marijuana product compliance (WAC 314-55-107 and sections within Chapter 246-70 WAC)
- Pesticide action levels (WAC 314-55-108)

(4) Maintain the current private accreditation provider until the new laboratory quality standards are in place.

(5) Designate Ecology’s Laboratory Accreditation Unit as the accreditation provider for Washington State cannabis testing laboratories.

Laboratories will be evaluated using LAU’s accreditation framework (Chapter 173-50 WAC) and revised cannabis-specific laboratory quality standards in Chapter 314-55 WAC. We recommend this because Ecology’s existing environmental and drinking water accreditation programs are successful models, and experienced staff can provide technical assistance to laboratories for essential quality assurance practices.

This recommendation is based on examination of current accreditation practices, review of other states’ approaches, and Ecology’s experience with scientific methodologies, good laboratory practices, and laboratory accreditation. A preliminary timeline for task completion is presented in Table 2.

Table 2. Proposed timeline for strengthening Washington’s cannabis laboratory accreditation program.

Task	Completion Date
Cannabis Science Task Force formed	January 2020
Task Force identifies early action priorities and work begins	March 2020
Task Force addresses early action priorities and reports to legislature	December 2020
Task Force develops new laboratory quality standards and reports to legislature	January 2022
WAC revisions begin	January 2022
WAC revisions complete	December 2023
Ecology’s LAU begins cannabis laboratory accreditation	January 2024

Conclusion

Based on our research and findings, multiple actions must take place to establish a robust and defensible cannabis laboratory accreditation program implemented by the Washington State Department of Ecology.

The primary challenge to developing a solid accreditation program for Washington State cannabis laboratories is the lack of established laboratory quality standards. Moving accreditation to Ecology will require the creation of a Cannabis Science Task Force to collaborate on the development of appropriate laboratory quality standards. The Department of Ecology, the Department of Health, the Department of Agriculture, and the Liquor and Cannabis Board should collaborate to ensure this Task Force has the appropriate expertise. The Cannabis Science Task Force should inform future WAC updates, which may require revision of language in at least nine WACs, as outlined in this report. The current accreditation process should remain intact while laboratory quality standards for cannabis testing and products are developed and WACs are revised. Finally, once laboratory quality standards are adopted into regulation, designate Washington State Department of Ecology's Laboratory Accreditation Unit as the accreditation provider for Washington cannabis testing laboratories.

Definitions

Accreditation – (WAC 173-50 definition) The formal recognition by the department [Ecology] that an environmental laboratory is capable of producing accurate and defensible analytical data. This recognition is signified by the issuance of a written certificate, accompanied by a scope of accreditation indicating the parameters for which the laboratory is accredited. The term “accredit” as used in this chapter is intended to have the same meaning as the term “certify” as used in RCW 43.21A.230.

Accreditation Standards (as used within this report) – Established criteria that describe the accreditation evaluation process to ensure accredited laboratories have the demonstrated capability to provide accurate, defensible data. Accreditation standards include descriptions of authority (i.e., granting, denying, suspending, and revoking accreditation), accreditation certification cycle length (e.g., 1-year period), on-site audit frequencies, application process, fee structure, and other procedural specifics of the accreditation process. More specifically, the accreditation standard may identify critical items (e.g., appropriate implementation and use of methods and standard operating procedures, use of quality control samples, and passing proficiency testing sample results) that will be assessed or evaluated as a part of the accreditation process.

Accuracy – A measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias), components that are due to sampling and analytical operations (EPA, 2005).

Analyte – The constituent or property of a sample measured by an analytical method.

Approved methods – Standard methods or other methods recognized by an entity (oversight program, government body) as applicable for use within a defined system.

Audit – A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives (EPA, 2001).

Audit (technical systems) – A thorough, systematic, on-site, qualitative audit of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a system (EPA, 2001).

Bias – The difference between the population mean and the true value. Bias usually describes a systematic difference reproducible over time, and it is characteristic of both the measurement system and the analyte(s) being measured.

Critical elements – Items that are necessary for consistent generation of accurate and defensible data. These elements are the subject of intense scrutiny throughout the accreditation process.

Certification – Used to mean the same as accreditation in this report. Certification and accreditation may be defined in other systems as separate or unique concepts.

Comparability – The qualitative term that expresses the confidence that two data sets can contribute to common interpretation and analysis of the parameter or matrix of interest.

Completeness – A measure of the amount of usable data obtained from a measurement system, expressed as a percentage of the number of measurements that should have been collected according to the study design.

Data quality indicator – The quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal indicators of data quality are precision, bias, accuracy, representativeness, comparability, completeness, and sensitivity (EPA, 2005).

Initial demonstration of capability (IDC) – Before analyzing compliance samples, an analytical team must demonstrate acceptable precision, accuracy, sensitivity, and specificity for the method to be used (EPA, 2005).

Intralaboratory Comparison – A study of an analytical method for which repeatability and reproducibility are measured within a single laboratory.

Interlaboratory Comparison – A collaborative study of an analytical method for which repeatability and reproducibility are measured in at least two laboratories.

Laboratory Quality Standards (as used within this report) – Established criteria designed to produce accurate and reproducible data. Deliberate and intentionally designed laboratory quality standards ensure that established product standards can be met. In broad terms, laboratory quality standards are defined methods, method validation protocols, and performance criteria (e.g., use of quality control samples and their tolerance limits). These provide laboratories standardized requirements to follow, and also give accreditation providers critical elements to assess during the accreditation process.

Limit of quantitation (LOQ) – The smallest measured amount of analyte in a sample that can be reliably quantified with a specified degree of precision.

Lower limit of quantitation (LLOQ) - defined as the lowest point of quantitation, which, in most cases, is the lowest concentration in the calibration curve. The LLOQ is verified periodically with blank spikes, also known as laboratory control samples (LCSs) using lab-specific statistically based recovery limits, or project limits (EPA, 2005).

Matrix (pl. matrices) – The material or compound in which an analyte is retained.

Method – A formalized group of procedures and techniques for performing an activity, systematically presented in the order in which they are to be executed.

Method detection limit (MDL) – The minimum amount or concentration of analyte in the test sample that can be reliably distinguished from zero. MDL is dependent on sensitivity, instrumental noise, blank variability, sample matrix variability, and dilution factor (FDA, 2015b).

Method validation – The process of demonstrating that an analytical method is suitable for its intended use. It involves conducting a variety of studies to evaluate method performance under defined conditions (EPA, 2006).

Method verification – The process of demonstrating that a laboratory is capable of replicating a validated method with an acceptable level of performance (FDA, 2015b).

Parameter – The combination of one or more analytes determined by a specific analytical method. Example: The analyte zinc by method EPA 200.7 (Ecology, 2010).

Peer review – a documented critical review of work by qualified individuals (or organizations) who are independent of those who performed the work, but are collectively equivalent in technical expertise. A peer review is conducted to ensure that activities are technically adequate, competently performed, properly documented, and satisfy established technical and quality requirements. The peer review is an in- depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to specific work and of the documentation that supports them (EPA, 2001).

Performance criteria – Defined, measurable performance characteristics of an analytical method or process-specific requirements for accuracy, precision, recovery, specificity (selectivity), sensitivity (limits of detection), inclusivity, exclusivity, linearity, range, and scope of application. Criteria may also be set by defining process, i.e., method validation protocols.

Precision – A measure of variability in the results of replicate measurements caused by random error. Also referred to as imprecision. Precision is usually measured as the standard deviation, relative standard deviation, or relative percent difference (Ecology, 2010).

Proficiency testing sample (PT sample) – A sample provided to a laboratory for the purpose of demonstrating that the laboratory can successfully analyze the sample within acceptance limits specified in the regulations. The qualitative and/or quantitative composition of the reference material is unknown to the laboratory at the time of the analysis (EPA, 2005).

Product Standards (as used within this report) – Established regulatory requirements that products or materials that are produced for consumers must meet. Compliant products under these standards are asserted to be safe, free from contaminants, and produced to a specified composition or dosage requirements. Current cannabis standards include potency levels, pesticides action limits, mycotoxin limits, packaging requirements, and others.

Quality assurance (QA) – An integrated system of management activities involving planning, implementation, documentation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client (EPA, 2001).

QA manual – A document describing the policies, organization, objectives, and specific QA and QC practices within a laboratory.

Quality control (QC) – The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality (EPA, 2001).

Quality System – The means by which an organization manages its quality aspects in a systematic, organized manner. It provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required QA/QC activities. It encompasses a variety of technical and administrative elements, including:

- policies and objectives
- organizational authority
- responsibilities
- accountability
- procedures and practices (EPA, 2002)

Repeatability – The measure of variability derived under specified repeatability conditions, such that independent test results are obtained with the same method on identical test items in the same laboratory by the same analyst using the same equipment, batch chemicals and media, and tested in a short period.

Reproducibility – The measure of precision derived under reproducibility conditions, such that test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment. A valid statement of reproducibility requires specification of the conditions used.

Robustness – The measure of an analytical method’s capacity to remain unaffected by small but deliberate variations in method parameters. This provides an indication of its reliability during normal usage (FDA, 2015b).

Selectivity – The change in instrument response that corresponds to a change in the measured quantity (e.g., analyte concentration). Selectivity is commonly defined as the gradient of the response curve or slope of the calibration curve at a level near the LOQ (FDA, 2015b).

Sensitivity – The ability to detect small changes in the concentration of an analyte in a sample.

Specificity – In quantitative analysis, specificity is the ability of a method to measure an analyte in the presence of components that may be expected to be present. The term *selectivity* is generally preferred over *specificity* (FDA, 2015b).

Standard Methods – Methodology from a government publication or peer-reviewed literature, usually widely accepted based on use of rigorous method validation protocols used during development.

Standard operating procedure (SOP) – A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps, and that is officially approved as the method for performing certain routine or repetitive tasks (EPA, 2001).

Validated methods – The methods that have undergone validation.

Validation (method) – The process of demonstrating or confirming the performance characteristics through assessments of data quality indicators for a method of analysis.

Acronyms and Abbreviations

A2LA – American Analytical Laboratory Accreditation
AHP – American Herbal Pharmacopeia
ANSI – American National Standards Institute
AOAC – Association of Official Analytical Chemists
APHL – Association of Public Health Laboratories
ASTM- American Society for Testing and Materials
BAM – Microbiological Methods and Bacteriological Analytical Manual
CAA - Clean Air Act
CDPHE – Colorado Department of Public Health and Environment
CWA - Clean Water Act
DEA – United States Drug Enforcement Agency
DOH – Washington State Department of Health
Ecology – Washington State Department of Ecology
EPA – United States Environmental Protection Agency
EPTAVU - Environmental Proficiency Testing and Validation Unit
FDA – United States Food and Drug Administration
FERN – Food Emergency Response Network
FSCS – Food Safety and Consumer Services
IEC - International Electrotechnical Commission
ILAC - International Laboratory Accreditation Cooperation
ISO – International Organization for Standardization
IUPAC – International Union of Pure and Applied Chemistry
LAU – Ecology Laboratory Accreditation Unit
MFRPS – Manufactured Food Regulatory Program Standards
MRA - Mutual Recognition Agreement
NELAP – National Environmental Laboratory Accreditation Program
NYSDOH – New York State Department of Health
OHA - Oregon Health Authority

ORELAP – Oregon Environmental Laboratory Accreditation Program

PAM – Pesticide Analytical Manual

PDP – USDA Pesticides Data Program

PJLA – Perry Johnson Laboratory Accreditation

RCRA - Resource Conservation and Recovery Act

SDWA - Safe Drinking Water Act

TNI – The NELAC Institute

UNODC – United Nations Office of Drugs and Crime

USDA – United States Department of Agriculture

USP – United States Pharmacopeia

WSDA – Washington State Department of Agriculture

WSLCB – Washington State Liquor and Cannabis Board

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Appendix A. Cannabis Laboratories for Which Ecology Received Accreditation Records

Lab name	City	Status	Initial certification date
Steep Hill Labs	Tukwila	Active	8/20/2014
Confidence Analytics	Redmond	Active	6/18/2014
HD Analytics	Lake Stevens	Withdrawn	1/26/2016
Analytical 360, LLC.	Yakima	Active	5/27/2014
True Northwest, Inc.	Olympia	Active	7/10/2014
Testing Technologies, Inc.	Poulsbo	Active	10/26/2016
G.O.A.T. Labs	Vancouver	Active	7/23/2014
Integrity Labs	Olympia	Active	8/19/2014
Anatek Labs	Spokane	Active	8/20/2014
Green Grower Labs	Spokane	Active	9/23/2014
Dragon Analytical Laboratory	Olympia	Suspended	1/9/2015
Trace Analytics	Spokane	Active	3/4/2015
Medicine Creek Analytics	Fife	Active	5/25/2016
Molecular Testing Labs	Vancouver	Active	9/23/2016
Praxis Laboratory	Centralia	Active	11/2/2017
Treeline Analytics, LLC.	Bellingham	Active	8/17/2018
Capitol Analysis	Lacey	Active	11/9/2016
Peak Analytics Lab Testing Services	Bellingham	Suspended	11/17/2015

Appendix B. Cannabis Laboratory Accreditation in Other States

Oregon

The Oregon Health Authority (OHA) accredits⁴⁹ cannabis testing laboratories under their existing Oregon Laboratory Accreditation Program (ORELAP). ORELAP functions as a federally recognized state body that has been authorized to provide accreditation of environmental laboratories under the National Environmental Laboratory Accreditation Program (NELAP) using TNI:2009 standards. Oregon’s ORELAP accreditation program provides laboratory certification for EPA regulatory programs that include testing in support of the Clean Air Act (CAA), the Clean Water Act (CWA), Safe Drinking Water Act (SDWA), and Resource Conservation and Recovery Act (RCRA). NELAP permits Oregon to define specific ORELAP criteria to meet OHA needs to implement their program. The scope of accreditation, the type of laboratory included under the state’s program (including the regulatory or voluntary nature of the program itself), the assessment of fees, and the use of third party assessors are all options of the state (NELAP, n.d.).

Oregon’s existing ORELAP program is a framework for their cannabis lab accreditation extension. OHA has further authored their own standard methods for sampling marijuana,⁵⁰ for use by testing laboratories. NELAP does not recognize these methods nor require their use. To further reinforce best sampling practices by qualified personnel, Oregon requires that all cannabis sampling must be performed by trained⁵¹ personnel employed by an ORELAP-accredited laboratory.

Oregon utilizes the same available producers of “surrogate” proficiency test (PT) samples as does many states, including Washington. However to fill the lack of relevant in-matrix PT samples, OHA has begun to collaborate with one proficiency test program provider, PHENOVA, to design PT samples using a cannabis flower/trim matrix. Currently only the cannabis flower/trim matrix PT samples are available for testing for pesticides and potency. Oregon’s statutes and logistical problems of sourcing (amount and location) and preparing material has impacted the robustness of this program. This currently limits the production of in-matrix PT samples to those made for testing potency (cannabinoids) and for those most affected by the presence of cannabinoids (pesticides). For in-matrix PT samples, once the cannabis is sourced, PHENOVA works in a host laboratory located within Oregon to complete the preparation of the PT samples. The prepared PT samples are delivered to or picked up by laboratories to begin testing.

PHENOVA also provides “surrogate” matrix proficiency tests for testing water activity and moisture, heavy metals, microbiologics, and aflatoxins. Their selection of “surrogate” PTs⁵² are

⁴⁹ <https://www.oregon.gov/oha/PH/LABORATORYSERVICES/ENVIRONMENTALLABORATORYACCREDITATION/Pages/cannabis-info.aspx>

⁵⁰ <https://www.oregon.gov/oha/PH/LABORATORYSERVICES/ENVIRONMENTALLABORATORYACCREDITATION/Pages/Sampling.aspx>

⁵¹ Training includes an initial 8 hours of classroom training, including principles, procedures, and policies of sampling; field or on-on-the job training in sampling; and an annual 8-hour refresher training.

⁵² PHENOVA does not use hemp, because their company has chosen to acknowledge all DEA gray-area restrictions on shipment of hemp.

produced at their Colorado headquarters. Currently, there is no requirement specifying that when an in-matrix cannabis flower/trim PT sample is available it must be used.

New York

The New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP), a separate independent program in the NYSDOH, serves as the accrediting authority over laboratories participating in their medical marijuana testing program. Since its inception in 1984, ELAP has been responsible for certifying states within New York for air quality and emissions, drinking water (SDWA), non-potable water, and solid and chemical materials/wastes (RCRA) to the NELAP TNI:2009 standard.

The NYSDOH adapted their existing environmental accreditation framework for accrediting cannabis laboratories. Cannabis testing laboratories are required to meet the standards set forth in the ELAP Quality System Standards (NYSDOH, 2002) and use specified department-written analytical methods and protocols.⁵³ The NYSDOH developed and published 21 cannabis-specific method protocols to cover preparation and analysis techniques for cannabinoids, microbiologics, mycotoxins, metals, and pesticides to fill the void of validated standard methods. These methods were based on EPA and USP consensus methods by department scientists experienced with these methodologies. This strategy allows for complete control of methods and method validation protocol, and ensures the all laboratories are accredited to the same methods and performance criteria specific to cannabis.

The NYSDOH also houses an ISO/IEC 17043– and ISO/IEC 17025–accredited and NELAP-recognized entity that provides environmental proficiency testing (PT) samples nationally. The NYDOH Environmental Proficiency Testing and Validation Unit (EPTAVU) is comprised of several state health and environmental laboratories that collaborate to produce and validate PT samples for various testing schemes covering the common environmental parameters. Although a robust PT program design framework exists, currently the EPTAVU does not manufacture cannabis-specific proficiency samples for use by New York marijuana testing labs.

Colorado

Regulation of retail marijuana in Colorado is by the Department of Revenue’s Marijuana Enforcement Division, and regulation of medical marijuana is through the Colorado Department of Public Health and Environment (CDPHE). The State Marijuana Laboratory Sciences division, a program within the CDPHE, was granted authority for implementing the statewide marijuana (retail and medicinal) testing laboratory certification program.

The CDPHE provided consultation for all of the scientific aspects of the state’s marijuana program. Currently the department fills several roles in the state’s cannabis program, in addition to running the marijuana laboratory accreditation program. As a multidisciplinary department, the CDPHE is comprised of many types of science professionals, including chemists, toxicologists, medical doctors, and a variety of other public health specialists. Collectively the CDPHE oversees and

⁵³ <https://www.wadsworth.org/regulatory/elap/medical-marijuana>

facilitates routine duties for protection of public health; technical assistance on laboratory and quality assurance; studies on cannabis use, trends, and impacts; and food safety and waste disposal programs. For marijuana sciences, they served and continue to serve as the authority on marijuana laboratory science and practices.

In response to the lack of a standard testing model and concern for the variability in the initial data generated from testing laboratories, the CDPHE developed an approved methods reference library in 2015. The reference library houses CDPHE-approved validated analytical methods and authoritative approaches for the testing laboratories to draw from. With exception to the potency determination, several methods are listed as available to select from for each field of testing. Vetted methods include those employed in government programs or developed by consensus organizations, following method development and validation protocols and policy. Several AOAC, FDA, ASTM, USP methodologies are listed as permissible for use when all applicable controls are incorporated. For the potency analysis, no one method is validated to a level CDPHE recognizes as a validated standard method. For potency, the laboratories are permitted to develop their own protocol from journal articles, papers, or application notes, provided they follow validation protocols from an approved governmental or consensus method program.

To fill the gap in the lack of in-matrix PT samples for potency, the CDPHE established a state PT program, handled by their Health Division, whereby they source cannabis and cannabis products from within their state to manufacture potency PT samples. Their program sources three matrix types from alternating growers and producers to use as PT samples: flower, edibles, and concentrates. Upon agreement with all certified laboratories during stakeholder advisory sessions, the sourced material is brought by a Colorado health scientist to a certified laboratory for processing. Each testing laboratory serves as a host for this process. The Colorado Health scientist homogenizes and subsamples the material for the certified laboratories to then pick-up themselves. Since there is no true value assigned to the material at distribution, Colorado uses the individual test results to generate a robustified mean, to which each laboratory's test result is then tested against.