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Recommendations for Cannabis Testing: Laboratory Compliance

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Abstract

Designed as a follow-up to the *Agilent United States Cannabis Testing* white paper,[1] this technical overview will present recommendations to the industry on laboratory compliance. These recommendations are based on thorough research of state regulations and industry experience in data quality. All states that have legalized the use of cannabis require the safeguarding of testing data and accuracy of laboratory equipment. Paired with Agilent products and services, these recommendations will help your laboratory remain compliant as regulations continue to grow and mature.

Agilent compliance products and services are designed with current and future cannabis requirements in mind. Partnering with Agilent will help future proof your laboratory and reduce your risk from regulatory action.

Introduction

With the growing popularity of cannabis, state governments have been struggling to ensure the quality and safety of these products. Due to industry immaturity and a lack of testing standardization, states are constantly revising and altering regulations. For a cannabis testing facility in a state where cannabis has been legalized, navigating this regulatory landscape can be difficult, and preparing for the future can seem daunting. In the Agilent white paper *United States Cannabis Testing: Laboratory Compliance*[1], state laboratory regulations are broken down into three fundamental compliance topics:

1. Qualification/calibration of laboratory equipment
2. Data retention and availability
3. Data integrity controls

All three topics are of critical importance for cannabis testing facilities and their individual concepts are further evaluated in the white paper. As the cannabis industry continues to mature, it is expected that laboratory regulations will become increasingly stringent.

This technical overview will provide recommendations from Agilent for the industry concerning these topics. These recommendations are based on thorough research of state regulations and industry experience in data quality. Paired with Agilent products and services, these recommendations will help your laboratory remain compliant with current and future regulatory requirements.

Agilent: a leader in cannabis testing

With 30+ application notes and publications covering the entire operation of a standard cannabis testing facility. Agilent is at the forefront of cannabis analysis. All Agilent solutions and equipment are robust and maximize throughput to meet your individual laboratory needs.

As regulations continue to evolve, Agilent is ready to help you navigate increasing compliance requirements. With over 25 years of compliance delivery, Agilent was voted number one for instrument and software qualification and computer system validation services from an independent survey conducted in 2019.[2] When considering different vendors, align your laboratory with a company that will harmonize and future proof your organization.

Agilent recommendations for cannabis testing laboratory compliance

The following sections describe Agilent recommendations for cannabis testing facilities. These recommendations have been designed to assist laboratories in complying with state regulations as well as ISO 17025 accreditation.

Qualify/calibrate laboratory equipment

Follow a risk-based approach to evaluating the performance of laboratory equipment. Computerized equipment, such as chromatography instrumentation, capable of affecting laboratory conclusions should be controlled via an instrument life cycle. Plans should include regular maintenance and verification of equipment's individual parameters at periodic time points. High-risk parameters need to be measured for the equipment's entire range of use with calibrated tools. This should be followed by a periodic holistic chemical check demonstrating the instrument's functionality. These activities are normally broken into four events: Design Qualification (DQ), Installation Qualification (IQ), Operational Qualification (OQ), and Performance Qualification (PQ).[3] Regulatory guidance on instrument qualification/calibration can be found in United States Pharmacopeia's (USP) General Chapter <1058>.

Failure analysis demonstrates the effectiveness of operational qualifications (OQs) at identifying instrument failures over the popular cannabis proficiency tests (Table 1). This form of analysis was adopted by Bob McDowall in a 2020 article from *LCGC North America*.[4] In this article, McDowall classifies instrument failures into two categories: catastrophic or performance drift. Holistic testing (such as proficiency tests) provides assurance that a system's individual modules are functioning successfully as a base unit but provides little detection regarding performance drift. With the use of external calibrated tools and specifically designed testing methods, operational qualifications can identify performance drift failures before they impact laboratory results.

When selecting laboratory equipment and designing a qualification plan, ensure that the manufacture's specifications and the qualification range meet user requirements. This can be easily documented and achieved by following the format of Bob McDowall and Paul Smith's example in Table 2.[5] In this example, the laboratory has documented its method parameters range under the "Setting" column for each analytical method. Once this is done, the maximum and minimum values are used as the equipment's user requirements. If the instrument specification fails to meet these user requirements, the instrument is not fit for its intended use. Finally, laboratories must ensure that the equipment's reoccurring OQ will physically qualify the entire user requirements range. More information on this chapter can be found in Bob McDowall and Paul Smith's four USP <1058> white papers.[5]

Table 1. Example of a liquid chromatography failure analysis.

Module	Possible Failure	Common LC Assessment Methods		
		Observational/Tune	Proficiency Testing*	Operational Qualification
Pump	Wrong flow rate	red	yellow	green
	Variable flow rate	red	yellow	green
	Gradient error	red	yellow	green
	Instrument leak	yellow	yellow	green
Injector	High temperature	red	red	green
	Low temperature	red	red	green
	Carryover	red	red	green
	Poor injection precision	red	yellow	green
	Poor injection linearity**	red	red	green
Column Oven	High temperature	red	red	green
	Low temperature	red	red	green
	Variable temperature	red	red	green
Detector	Poor detector response	red	green	green
	Wrong wavelength	green	green	green
	Poor mass selectivity	green	yellow	green
System (Holistic) Test	Integrated test of all system components	red	green	green

Key: green = Likely to detect yellow = Could detect red = Unlikely to detect
* Dependent on lab proficiency test requirments
** Optional Agilent test

Table 2. Example of user requirements, associated instrument specifications, and OQ protocol tests (McDowall and Smith).[5]

Use	Module	Setting	User Requirements	Instrument Specification	OQ Protocols Criteria to Verify Intended Use
Method	Pump	Flow	Range (mL/min)	0.001 to 10	
				Accuracy	Accuracy
A		0.5	0.5 to 2.1	≤1%	≤5.00%
B		2.1		Precision RSD	Precision RSD
C		1.8		≤0.07%	≤0.50%
Method	Pump	Gradient Formation	Range (%B)	0 to 100, in 0.1 increments	Steps 20, 40, 60, and 80%
A		35 to 75	25 to 75	<0.2 %RSD	Accuracy ≤2.00%
B		NA (Isocratic)			Linear gradient 100 to 0% (R^2 ≥0.999)
C		25 to 45			
Method	Autosampler	Temperature	Range (°C)	4 to 40 °C	Accuracy
A		NA (Ambient)	4	4 to 5 °C below ambient	Difference from setpoint ≥−2.0 °C and ≤5.0 °C
B		4			
C		4			

If resources and instrument expertise are lacking, consider outsourcing these services. Agilent can deliver regular preventative maintenance and qualification services as directed by your instrument life cycle. Agilent engineers will clean/replace commonly contaminated/spent parts to ensure that your instruments deliver peak performance while minimizing unplanned downtime. This can be followed by an OQ, a metrology and holistic based testing suite that confirms critical system functions. OQs can be customized to align with your laboratory's user requirements. With the Agilent Automated Compliance Engine (ACE), qualifications can be done quickly, electronically, and securely. For more information, see the *Agilent Equipment Qualification Solution* brochure.[6]

Data retention and availability

The retention and availability of records is a requirement for all cannabis testing facilities. This applies not only to certificates of analysis, but to all the documents or data files that were used to support your conclusion. Laboratories can archive their static data (paper records) in their designated records retention room, but dynamic data (e.g., chromatograms) cannot be properly stored in this fashion. The difference between static and dynamic data is discussed in the Agilent white paper *United States Cannabis Testing: Laboratory Compliance*.[1] To ensure data retention, first captured electronic and processed data should be handled by a content management system to safeguard the originality and availability of your laboratory's analytical data.

Your management system should be designed to harmonize, centralize, and protect your laboratory's data. This can easily be achieved using Agilent OpenLab ECM, an Enterprise Content Management system. ECM can store and secure all your data, from any technology or vendor that your lab produces including documents your lab may use to support its activities. It silently monitors your operation and secures data in a central location while ensuring timely completion of approvals, customized tasks, and lab-wide reports.

– Multiformatted data sweeping capability

– Single location for laboratory data

– Data event logger with search features for easy periodic review of all ECM data

– Data version capturing

– Electronic review

– Customizable user roles and privileges

For more information, see the *Agilent OpenLab Data Management Solutions* brochure.[7]

Data integrity controls

In the Agilent white paper, United States Cannabis Testing: Laboratory Compliance, the advantages of technical controls for safeguarding data are explained.[1] Despite the benefits of technical controls, many laboratories are still heavily reliant on procedures alone to enforce quality policies. This can lead to exorbitant amounts of wasted time, transcription errors, deviations from working instructions, and even fraudulent cases. Invest in your laboratory's data security and automation by using compliant capable acquisition software. The two largest Agilent chromatography software platforms, Agilent OpenLab CDS and Agilent MassHunter allow for easy customized control over your system. Avoid the use of Microsoft Excel and Adobe PDF programs for data processing, as their technical controls are limited.
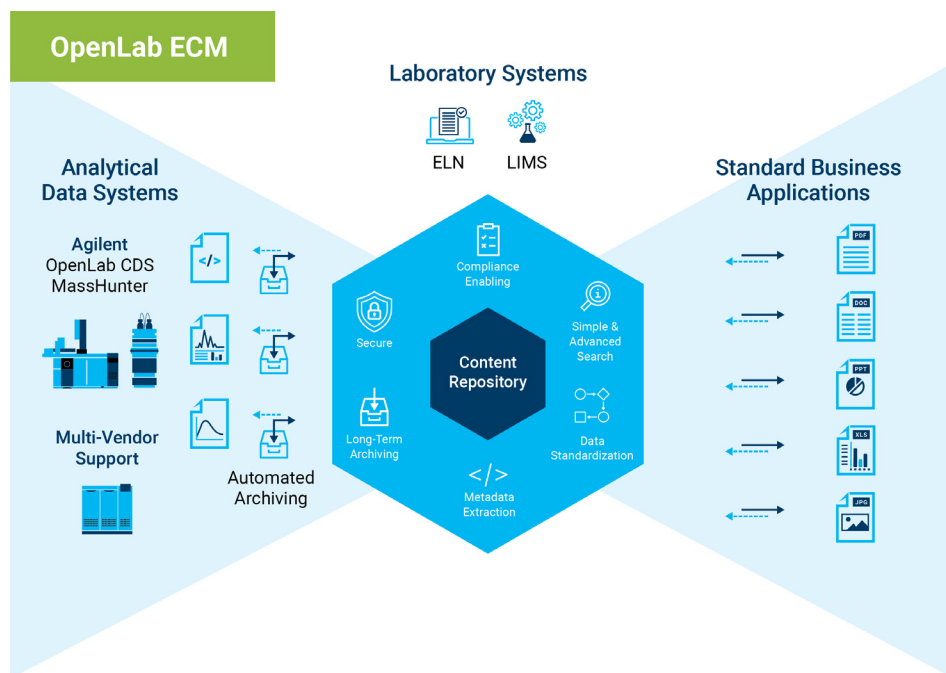

Figure 1. OpenLab ECM gives you a single repository for all your laboratory and non-laboratory data, content, and processes. The platform seamlessly integrates with common chromatography data systems, as well as other laboratory systems.

Protect your laboratories source data with OpenLab CDS and MassHunter

Safeguarding acquisition data is crucial to maintaining the integrity of your laboratory's conclusions. With the advanced controls in OpenLab CDS and MassHunter, protecting your source data could not be easier.

– System security policies (screen timeout, password length, password frequency, etc.)

– Ability to create unique user accounts and roles (User, Manager, IT, etc.) to prevent the unauthorized deletion and alteration of data

    – Software and project logon access

    – Personalized user controls over instrument, project, method, sequence, data, and report access from within the acquisition software

– Ability to customize automated electronic analysis reports to meet internal SOPs

– Detailed audit trails with search features for easy periodic review

Regardless of the software you choose, data integrity controls are not enabled out of the box and will require strategic setup and validation to comply with regulations. Given the infinite number of computer system setups, PC, and software manufacturers are incapable of combing through and looking for system bugs. Some of these bugs can take years to find and can be devastating to business function. Computerized System Validation (CSV)

is necessary to demonstrate that your setup is without critical errors and secure from data manipulation. Validation is not just a single event (like a qualification), but a controlled process that ensures your computerized systems are compliant throughout their entire operational lifetime. Take the time to document your computer's user and regulatory requirements and how those requirements are met by software controls. Controls that cannot be addressed by your software should be mitigated through procedures. Validate the system by testing these customized controls.

– Document user, regulatory, and manufacturer requirements

– Document how the system setup will meet the above requirements

    – Determine system vulnerabilities and create procedural controls to mitigate them

– Set up the system as documented

– Challenge the system to ensure data security and proper setup

    – Test custom user roles and privileges

    – Test custom calculations

    – Test the function of audit trails for high-risk actions

    – Test backup and archival procedures

– Create a user training plan

– Create a change control process to maintain the system's validated state during planned changes
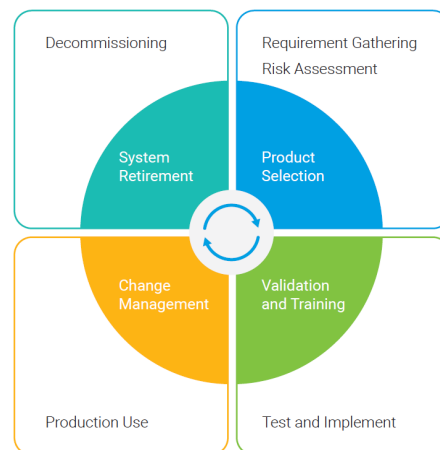

Figure 2. Life cycle of Computer System Validation

If the software is unfamiliar, resources are restricted, or you lack a validation expert, consider leveraging the knowledge of your software manufacturer to assist you. Agilent has a team of compliance experts that can assist you in the validation of your computer system and make recommendations based on your needs. These services have been designed to reduce the time and money necessary to validate your laboratory's computerized system. For more information, see the *Agilent Computer System Validation Services* brochure.[8]

Conclusion

State regulations overseeing the testing of cannabis products will only become more stringent as the industry matures. As discussed in the Agilent white paper *United States Cannabis Testing: Laboratory Compliance*, all states that have legalized the use of cannabis require the safeguarding of testing data and accuracy of laboratory equipment.[1] Agilent products and solutions can help laboratories comply with current and future regulations, but the onus still falls on the testing facility. Ensure that your laboratory is audit-ready by being proactive with your laboratory compliance.

Further reading on Agilent software data integrity controls can be found in the following white papers:

– Support for Title 21 CFR Part 11 and Annex 11 Compliance: Agilent OpenLab CDS[9]

– Support for Title 21 CFR Part 11 and Annex 11 Compliance: Agilent MassHunter for LC/MS[10]

– Support for Title 21 CFR Part 11 Compliance: Agilent MassHunter for GC/MS[11]

References

1. United States Cannabis Testing: Laboratory Compliance, *Agilent Technologies white paper*, publication number 5994-3057ENUS, **2021**.

2. Insights From Global Compliance Services Survey, *Agilent Technologies flyer*, publication number 5994-1752EN, **2020**.

3. Why Laboratory Compliance is Essential to Valid Analytical Results, *Agilent Technologies brochure*, publication number 5994-2148EN, **2020**.

4. McDowall, B. "COVID-19 and Data Integrity: What Does Lockdown Mean for Chromatograph Qualification and Calibration?" LCGC North America 38.5 (**2020**): 291–298, 307. Web.

5. What Has Changed with the 2017 Version of USP <1058>?, *Agilent Technologies white paper*, publication number 5991-9418EN, **2019**.

6. Agilent Equipment Qualification Solutions, *Agilent Technologies brochure*, publication number 5989-4440EN, **2020**.

7. Agilent OpenLab Data Management Solutions, *Agilent Technologies brochure*, publication number 5994-1433EN, **2019**.

8. Agilent Computer System Validation Services, *Agilent Technologies brochure*, publication number 5994-1753EN, **2020**.

9. Support for Title 21 CFR Part 11 and Annex 11 compliance: Agilent OpenLab CDS, *Agilent Technologies white paper*, publication number 5994-2223EN, **2020**.

10. Support for Title 21 CFR Part 11 and Annex 11 Compliance: Agilent MassHunter for LC/MS, *Agilent Technologies white paper*, publication number 5994-0573EN, **2019**.

11. Support for Title 21 CFR Part 11 Compliance: Agilent MassHunter for GC/MS, *Agilent Technologies white paper*, publication number 5991-6909EN, **2016**.

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