Overview of Considerations for Laboratory Testing in the Cannabis Industry

Jeremy Applen
CEO Atlas gXp
Vice Chairman
ASTM Committee D37 on Cannabis
Jeremy@atlasgXp.com
505-232-0599

Why Test?

- Testing is the final verification that quality measures are working as intended to ensure products meet specifications for purity, consistency and strength.
  - Confirm Regulatory Compliance
  - Ensure Product Safety and Consistency
  - Support Process Improvement

Confidence in Test Results

First-of-its-kind ongoing open dataset for adult use of Cannabis: tool development and real-time trend-monitoring

Marion McNabb[1], Nigam Arora[1], Christina Miyabe Shields[1], Karl Williams[1], Cody White[1], Neil Ritter[1], Randy MacCaffrie[1], and Steven White[2]

[1] Cannabis Community Care and Research Network (C3RN) [2] University of Massachusetts, Dartmouth

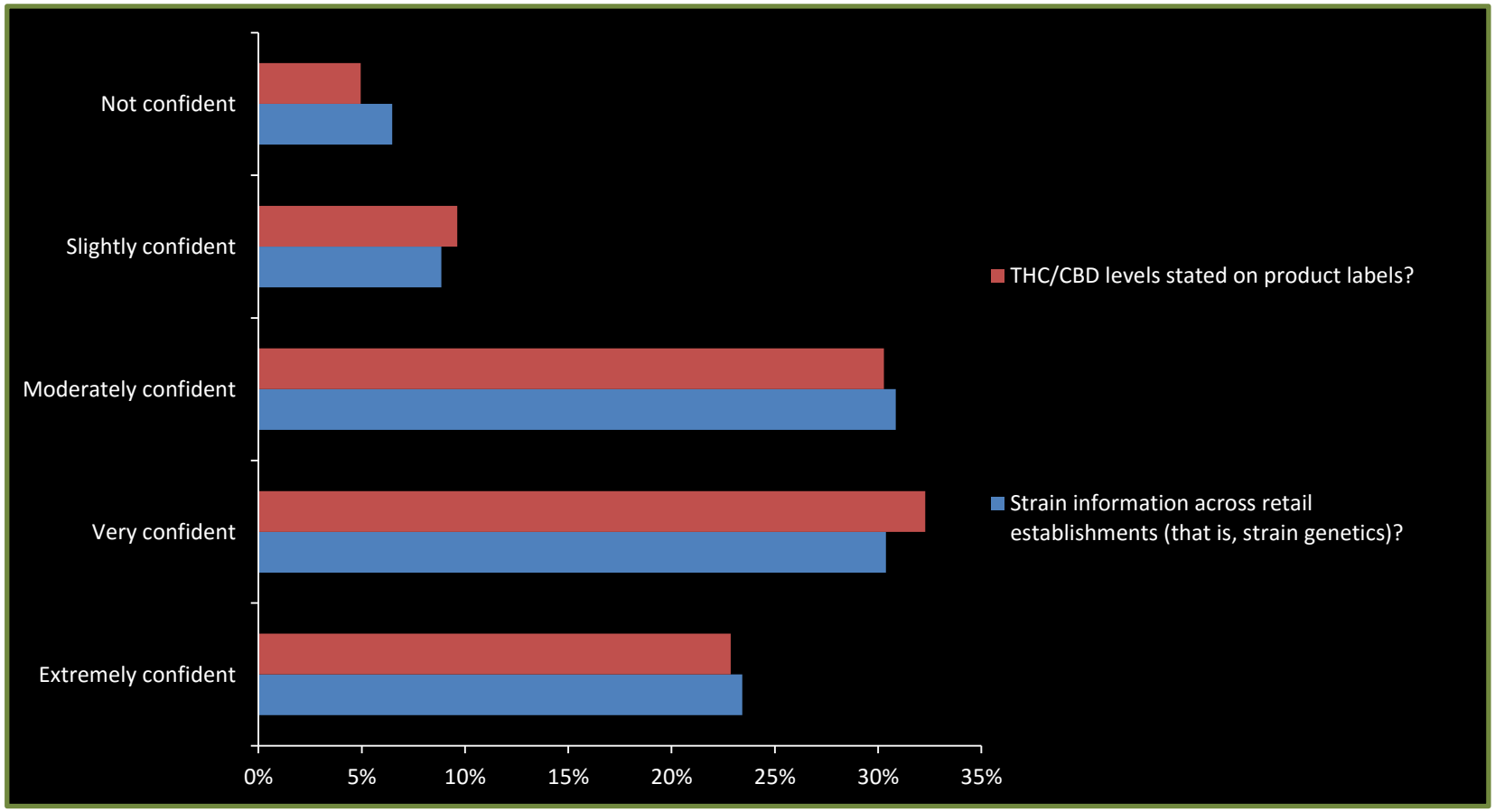
CANNABIS COMMUNITY CARE AND RESEARCH NETWORK®

UNIVERSITY OF MASSACHUSETTS DARTMOUTH 1895

- Nationwide study run in collaboration with University of Massachusetts Dartmouth
- Respondents = 1050
- 70 question survey asking about health conditions, products used, reduction in prescription medications, and more
- Survey also being using in local pilot study with three MA medical dispensaries
- Nationwide data collection ongoing through C3RN website

Is it There?

Respondent's level of confidence in…



Accreditation: The Path to Confidence

- Accreditation Standards
  - ISO
  - NELAC
  - ASTM
- Pathway for Investigation
- Confidence in Data and Product Safety
- Trust Between Industry, Regulators and Consumers

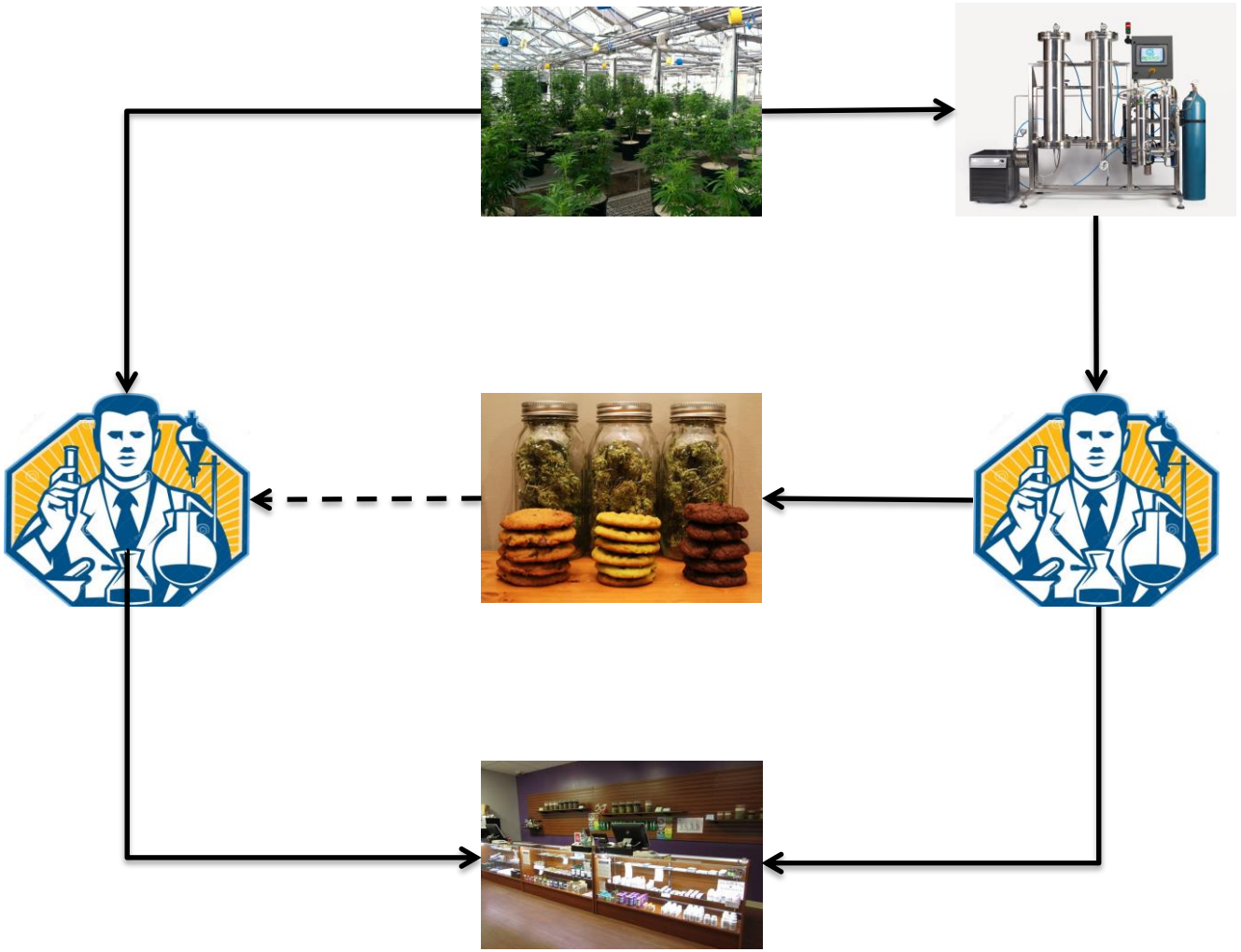
What is Quality Management?

- Quality Management
  - What do we do?
  - How do we do it?
  - Prove that we do what we say we do, the way we say we do it.

Quality Management

- Training
- Facilities
- Equipment
- Utensils
- Maintenance
- Sanitation
- Calibrations
- Components
- Specifications
- Treatments
- Adjustments
- Packaging
- Labeling
- Sampling
- Out of Specification Investigations
- Complaints, Returns, Recalls

Where Does Testing Fit?



Does Every Test Need To Be Done At Every Stage?

- Flower for Extraction
  - Water Activity and Moisture?
  - Potency
  - Pesticides
- Concentrate for Infusion
  - Potency
  - Pesticides?
- Finished Product
  - Flower, Concentrates, Edibles
    - Potency
    - Micro
    - Water activity/Moisture
    - Metals
    - Pesticides
    - Residual Solvents

Barriers to Effective Testing Programs

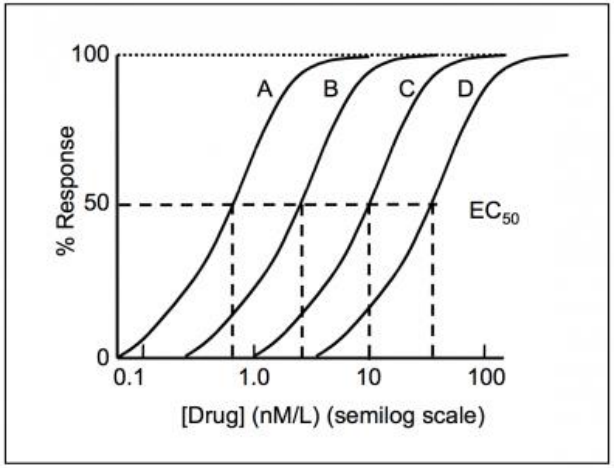
- Lab Industry
  - Equipment and Personnel
  - Lab Quality Control (ISO 17025)
  - Method Development and Validation
- Regulators
  - Time/Staff
  - Budget
  - Knowledge
- Legislation
  - Interagency Cooperation
  - Budget
- Industry
  - Lobby and Lawsuits

What Do We Test For?

- Potency
- Biological Contaminants
  - Water Activity/Moisture Content
- Pesticides
- Heavy Metals
- Residual Solvents
- Contaminants and Filth

Potency Analysis

- Sample Collection
- Acidic vs NonAcidic Cannabinoids
- Gas Chromatography (GC) vs Liquid Chromatography (LC)
- Overdose/Underdose
- Lab Shopping
  - High#'s = High $$$'s
  - Consumer Fraud



Case Study 1

- Cannabis flower material was transferred to a toll processor for extraction and refinement into concentrate
- Product was returned and lab analysis showed unusually low THC content.
- Lab disclosed the presence of an "Unknown Peak"
- The lab Wouldn't Share analytical Data but insisted the "Unknown peak was a suspected d-9 THC Isomer aka: Spice
- Dept. of Health Notified
- No response
- Product was voluntarily removed from shelves but not recalled

Case Study 1: Would ADE's Be Seen?

- Probably not. But Why?
  - Health Care Providers Don’t Ask
  - Perception of Safety
  - Fear of Retribution

Case Study 1: What Wasn't it Investigated?

- Limited Resources
  - Time
  - Staff
  - Knowledge
- Legislative barriers
  - Interagency Cooperation
- Fear of Industry Lawsuits

Microbiology

- Sample Collection
  - Smaller flowers decrease likelihood for failure
- Water activity impacts ability of organisms to grow
- Sample Pretreatment
  - Passing results = Return Business
  - Microwave
  - UV-C <280 nm
- Appropriate threshold for product category

Microbiology

Analysis	USP <1111>	USP <2023>	Oklahoma (Proposed)
Total Aerobic Count	< 100 CFU/g	< 10,000 CFU/g	N/A
Total Combined Yeast and Mold	< 10 CFU/g	< 1000 CFU/g	< 10,000 CFU/g
Bile Tolerant Gram Negative	< 1 CFU/g	< 1000 CFU/g	N/A
E. Coli	< 1 CFU/g	< 1 CFU/g	< 1 CFU/g
Salmonella	< 1 CFU/g	< 1 CFU/g	< 1 CFU/g

Case Study 2

- A concentrate intended for distribution was analyzed for potency and adulterants.
- Analysis showed mold and enterobacteria contamination
- The product was quarantined pending an investigation.

Case Study 2

- Internal Investigation Showed
  - Compliance with internal production controls
  - Inability of product to support biological growth
  - Indicated potential secondary contamination during analysis
- Lab Investigation
  - Contaminated commercially sourced reagent
  - Over 50% of samples failed were false positives

Case Study 3

- An immunocompromised, kidney/pancreas transplant recipient presented with profound diarrhea, nausea and vomiting was admitted to hospital within 48 hours of smoking cannabis flower material. Is there a correlation?

Case Study 3

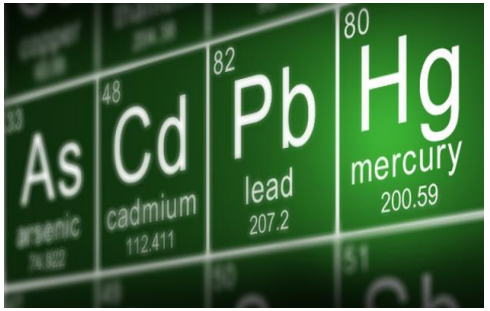
- The patient had been given the flower material to conduct a “taste test” for review on the same day samples of that product were submitted for lab analysis. The samples tested positive for enterobacteria >100 cfu/g and combined yeast and mold >1000 cfu/g.
- Medical tests identified the patient as having contracted both respiratory aspergillosis and bacterial gasterointestinal infections.
- Regulators contacted but pt refused to provide personal information. As a result no investigation was conducted
- Producer initiated root cause assessment and identified a single human vector

Pesticides

- All pesticides are illegal under Federal Law for application on cannabis unless approved by EPA
- Pesticides meeting the criteria described in the USEPA 40 CFR 180.950(a), (b), or (c)7 may be used as an inert ingredient in any minimum risk pesticide product applied to cannabis cultivation.
- Insufficient exposure information available to establish toxicity-based tolerances for pesticide residues in cannabis products.
- OR established action levels based on lab Limits of Quantification (LOQ)
- Sample Treatment
  - Accelerate Degradation
    - Products can be more dangerous

Heavy Metals

- Bioaccumulation
- Larger Risk in Outdoor Grows
- Reduce Cost Burden
  - Soils
    - Certificates of Analysis
    - Annual Testing
  - Water
    - Annual testing
  - Soil Amendments/Nutrients
    - Certificates of Analysis
- Sampling Bias



Residual Solvents

- No health-based solvent residual limits specifically for cannabis products
- Pharmaceutical limits provide a model
  - The USP National Formulary 18 Chapter 467 provides guidance for the use of solvents.
  - Chapter 467 has been adopted by many regulatory agencies in selecting solvents that may be utilized for extraction, as well as in setting the limits for residual solvents allowed in extracted products.
  - The solvents are broken down into three different categories.
    - Category 1 & 2: are either toxic or pose a significant enough health risk not to be utilized in the manufacturing of cannabis concentrates and extracts
    - Category 3: Low toxicity potential to humans with no health-based exposure limits.

Summary

- Testing is the last line of defense to verify regulatory compliance and product safety
- Accreditation to quality standards is important for data confidence
- Quality management should be adopted by the entire industry not just labs
- Testing requirements should reflect risk
- Not every question has a good answer yet

Thank You

Jeremy Applen

CEO Atlas gXp

Vice Chairman ASTM Committee D37 on Cannabis

Jeremy@atlasgxp.com

505-232-0599