Leading the
Science of Cannabis

Steep Hill™

Steep Hill, Inc. seeks to protect public health through the development of infrastructure and analytical services for legally-authorized cultivators, processors, distributors, retailers, and regulators of cannabis.

Contents

Understanding the Science of Cannabis

Cannabinoids are chemical compounds found in cannabis plants.

They're a subset of the 80-100 terpenoid-derived molecules found in significant amounts only in cannabis. Thus, all cannabinoids are terpenoids, but not all terpenoids are cannabinoids. They all have similar structures, but have been shown to have very different effects. Cannabinoids, are found in highest concentrations within the trichomes (or resin glands) found predominately on the female flowers. Most cannabinoids are found in both acid and neutral forms, which have distinctive medical qualities about them.

Decarboxylation

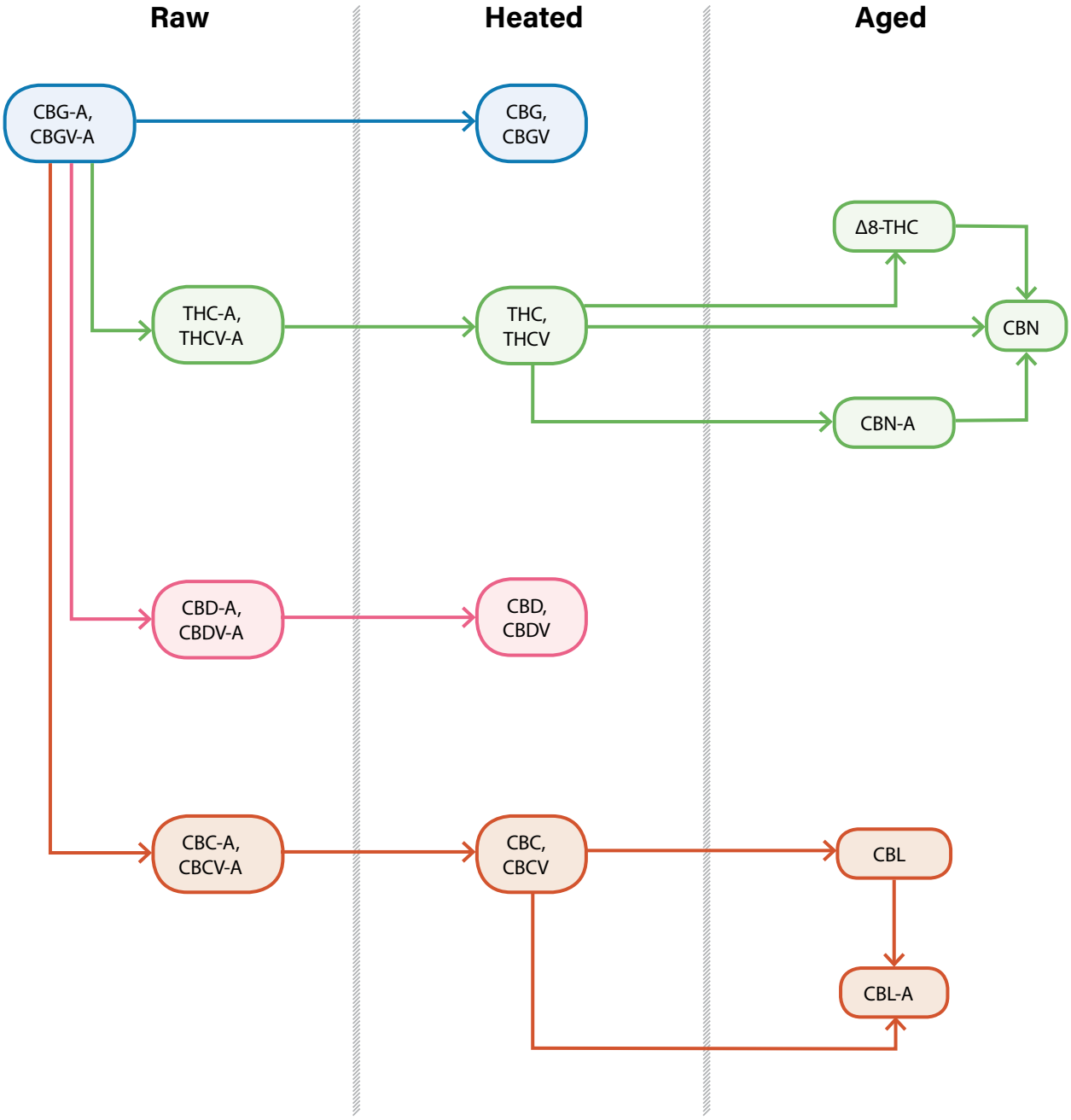
Decarboxylation is the conversion of a cannabinoid from acid form to neutral form, which occurs during heat exposure. For example, Δ9-THC is the result of THC-A ('A' for acid) decarboxylating. The main difference between the acid and neutral forms of Tetrahydrocannabinol (THC) is that only Δ9-THC causes the euphoric sensation associated with cannabis. THC-A, on the other hand, is not psychoactive! Δ9-THC is the best way to measure a cannabis product's psychoactive potency, and a typical cannabis plant contains about 13% to 25%.

Steep Hill quantifies up to over 20 cannabinoids:

CBG-A	Cannabigerolic Acid
CBG	Cannabigerol
THC-A	Tetrahydrocannabinolic Acid
THC-C4	Tetrahydrocannabinol-C4
THCV-A	Tetrahydrocannabivarinic Acid
Δ9-THC	Delta 9-Tetrahydrocannabinol
Δ8-THC	Delta 8-Tetrahydrocannabinol
THCV	Tetrahydrocannabivarin
CBN-A	Cannabinolic Acid
CBN	Cannabinol
CBD-A	Cannabidiolic Acid
CBDV-A	Cannabidivaric Acid
CBD	Cannabidiol
CBDV	Cannabidivarin
CBC-A	Cannabichromic Acid
CBC	Cannabichromene
CBL-A	Cannabicyclol Acid
	+ more

Cannabinoid Synthesis

By simply applying heat or exposing cannabinoids to light and air there are a multitude of opportunities for other cannabinoids.



Therapeutic Properties of Cannabinoids

Each cannabinoid offers unique medical properties. Many of them have been observed in clinical settings.

Raw

CBG-A
analgesic
anti-inflammatory

THC-A
anti-cancer
anti-inflammatory
anti-spasmodic

CBD-A
anti-cancer
anti-inflammatory

CBC-A
anti-fungal
anti-inflammatory

CBGV-A, THCV-A,
CBDV-A, CBCV-A
ant-inflammatory

CBG
analgesic
anti-bacterial
anti-cancer
anti-depressant
anti-fungal
bone stimulant

Heated

CBG
analgesic
anti-bacterial
anti-cancer
anti-depressant
anti-fungal
bone stimulant

THCV
anti-convulsive
anti-inflammatory
appetite suppressant
bone stimulant
neuroprotective

CBD
analgesic
anti-anxiety
anti-bacterial
anti-cancer
anti-convulsive
anti-depressant
anti-emetic
anti-inflammatory
anti-insomnia
anti-ischemic
anti-psychotic
bone stimulant
immunosuppressive
neuroprotective

Δ9-THC
analgesic
anti-bacterial
anti-cancer
anti-inflammatory
anti-spasmodic
appetite stimulant
bronchodilator
neuroprotective

CBDV
anti-convulsive
bone stimulant

CBC
analgesic
anti-bacterial
anti-cancer
anti-depressant
anti-fungal
anti-inflammatory
anti-insomnia
bone stimulant

Aged

Δ8-THC
anti-anxiety
anti-emetic

CBN
analgesic
anti-bacterial
anti-convulsive
anti-inflammatory

CBL
unknown

CBL-A
anti-inflammatory

Terpenoids

Terpenoids are the compounds responsible for a plant's fragrance.

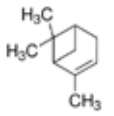
They are found within the resin glands (or trichomes). They interact with cannabinoids, called the 'entourage effect', which helps define a given strain's unique quality.

Mankind has been infatuated with terpenoids for thousands of years, enjoying the aromas and flavors in beer, candy, perfumes, fruits, incense and much more. In addition to the smells and tastes, we have continuously benefited from the diverse array of the medicinal and nutritional aspects found in terpenoids. Terpenoids likely make up the single largest family of chemical compounds available, from across the planet, to herbalists and apothecaries alike for use in compounding remedies and medicine.

We Quantify up to over 40 Terpenoids including:

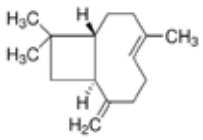
Linalool
Citronellol
Caryophyllene Oxide
Myrcene
Terpinolene
Limonene
Alpha Pinene
Alpha Humulene
Beta Carophyllene
Phytol
+ Plus Many Morel

Therapeutic Properties of Terpenoids and their Associated Fragrance



α-Pinene
anti-bacterial
anti-fungal
anti-inflammatory
bronchodilator

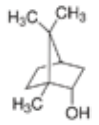

pine



β-Caryophyllene
anti-bacterial
anti-cancer
anti-fungal
anti-inflammatory
anti-septic

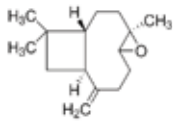

black pepper


clove



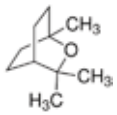
Borneol
analgesic
anti-insomnia
anti-septic
bronchodilator


camphor



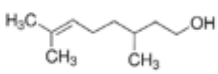
Caryophyllene oxide
anti-fungal
anti-ischemic


eucalyptus



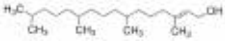
Cineol
anti-bacterial
anti-depressant
anti-inflammatory
anti-ischemic
bronchodilator


tea tree



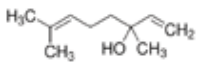
Citronellol
anti-cancer
anti-inflammatory
anti-insomnia
anti-spasmotic


rose



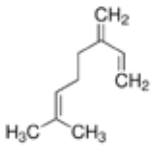
Phytol
anti-insomnia


green tea



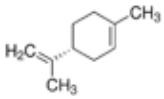
Linalool
anti-anxiety
anti-bacterial
anti-convulsive
anti-depressant
anti-insomnia


lavender



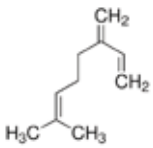
Humulene
anorectic
anti-cancer
anti-bacterial
anti-inflammatory


hops



Limonene
anti-anxiety
anti-bacterial
anti-cancer
anti-depressant
anti-fungal
bronchodilator

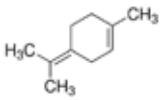

citrus



Myrcene
analgesic
anti-cancer
anti-inflammatory
anti-insomnia
anti-spasmodic

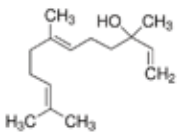

lemongrass


mango



Terpinolene
anti-bacterial
anti-fungal
anti-insomnia
anti-septic


lilac



Nerolidol
anti-fungal
anti-insomnia


wood


citrus rind

Cannabis Contaminants

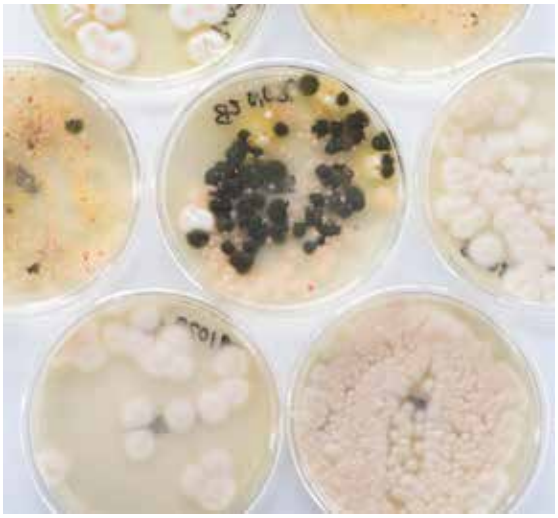
Potency is important, safety is our priority.

Residual Solvents

Residual Solvents are the leftover chemicals used to make various cannabinoid extracts. This method allows the lab to identify the extraction process and subsequent quality of any cannabis extract.

Pesticides

Pesticides are common in most agricultural settings. Cannabis is no different. Testing for these residues help protect the consumer from consuming hazardous chemicals like abamectin, bifenazate, and bifenthrin.



Mycotoxins

Mycotoxins are incredibly toxic by-products of some molds and fungi.

Microbes

Microbes are molds and bacteria that may pose a high risk to consumers (especially with suppressed immune systems.) The higher the concentration of these organisms, the greater the risk to consumers.

Heavy Metals

Cannabis collects heavy metals. It absorbs them from the growing environment. Therefore, a cannabis plant will absorb toxic compounds, including heavy metals, such as Lead, Cadmium, Mercury, and Arsenic. Even at extremely low levels, heavy metals can be extremely hazardous to one's health if ingested.

Types of Cannabis Products

Cannabinoids are infused into various consumer products.

Raw Flowers

Flowers are dried and cured female flowers cultivated from the cannabis plant. They contain cannabinoids in their acid forms, as well as a variety of terpenes.

Concentrates

Concentrates use solvents like Supercritical CO2 or Nitrogen to extract the cannabinoids from the cannabis plant into a substance with substantially higher concentrations. While most raw flowers test below 20% THC, some concentrates contain over 80% THC. Concentrates contain cannabinoids (in their acid and decarboxylated forms) as well as some terpenes, depending on the type of extraction method used.

Edibles

Edibles are food products infused with active cannabinoids, for example: they are available as baked goods, beverages, candy, and countless other items. Manufacturers usually make a cannabinoid extract using butter or a variety of oils, which they then use as an enhanced ingredient in their recipes.

Tinctures

Tinctures are infusions of alcohol, oil, or glycerin. They contain various levels of cannabinoid acids and their decarboxylated counterparts.

Steep Hill in the Lab

We are focused on measuring the purity and safety of all types of products containing active cannabinoids.

Testing & Analysis

We take the mystery out of medical cannabis through rigorous quality-standard protocols. We prove the safety, consistency, and potency of all cannabis products to bring guidance to distributors, cultivators, dispensaries, manufacturers, and consumers.

LIMS & Data Analytics

Steep Hill offers advanced LIMS and Data Analytics to help our clients succeed with total access to their test results, and the ability to perform analytics on their testing data.

Consulting

We offer consulting services in the areas of cannabis safety, regulation, testing methodology, packaging including labeling, scientific development, processing and regulatory management.

Steep Hill Testing Services

Testing services, including which instrumentation and testing specifications are used and followed, may vary from location to location

Cannabinoids (Potency)

Cannabinoids are the most abundant chemical compounds found in cannabis and are designated as the primary indicator of cannabis potency (particularly THC and CBD). High-Performance Liquid Chromatography (HPLC) or Gas Chromatography (GC) is used to analyze these compounds that are found in cannabis flowers, concentrates, and other infused products. Steep Hill provides one of the most comprehensive cannabinoid profiles available. We employ premium instruments and qualified methodologies to quantify up to 20 cannabinoids, depending on location.

Terpenes

Terpenes are the most abundant volatile compounds in cannabis and are responsible for the unique scent profile associated with various cannabis cultivars. Terpenes have been shown to exhibit medicinal properties, and, when combined with the medicinal properties of a particular cultivar's cannabinoid profile, contribute to a cultivar's unique physiological and psychological influence - a phenomenon known as the entourage effect. At Steep Hill, we leverage the powerful technologies of Gas Chromatography with Mass Spectrometry and Headspace Sampling to accurately detect and quantify up to 40 terpenes, depending on location.

Pesticides Analysis

Steep Hill offers quantitative pesticide reporting, which provides a clear understanding of a given pesticide contamination issue down to sub part per million levels. Steep Hill currently takes advantage of both LC-MS (Liquid Chromatography - Mass Spectrometry) and, in some locations, GC-MS (Gas Chromatography - Mass Spectrometry) techniques to provide quantified pesticide testing for dozens of targets, including: Abamectin, Bifenazate, Bifenthrin, Daminozide, Etoxazole, Fenoxycarb, Imazazil, Imidacloprid, Myclobutanil, Paclobutrazol, Pyrethrins, Spinosad, Spiromesifen, Spirotetramat, and Trifloxystrobin, and more, depending on location. Pesticide testing requirements vary state to state, however Steep Hill can help you better understand which requirements must be met in your state.

Mycotoxins Analysis

Mycotoxins are a toxic secondary metabolite produced by funghi and can be particularly harmful to humans if ingested. Steep Hill provides mycotoxin analysis for Aflatoxin B1, B2, G1, G2, as well as for Ochratoxin A, which is performed by LC-MS/MS (Liquid Chromatography - Mass Spectrometry).

Heavy Metals Analysis

Cannabis collects heavy metals. It absorbs them from the growing environment. The cannabis plant is an excellent bioremediator, soaking up large amounts of whatever the roots come in contact with. Therefore, a cannabis plant will absorb toxic compounds, including heavy metals, such as Lead, Cadmium, Mercury, and Arsenic. Even at extremely low levels, heavy metals can be extremely hazardous to one's health if ingested. Without uniform regulations for heavy metal testing, medical cannabis patients have no way of knowing whether their products are contaminated with these hazardous compounds – all of which pose serious health risks. For heavy metals testing, Steep Hill uses ICP-MS (Inductively Coupled Plasma - Mass Spectrometry) instrumentation to detect heavy metals at concentrations as low as one part per billion, giving patients and their caregivers additional assurance when it comes to the safety of their medicine.

Residual Solvents Analysis

Solvents are often used in the production/extraction of cannabis derivative products such as oils, distillates and other types of cannabis concentrates. Ideally, these solvents are totally purged from a product before packaging. Sometimes, however, residual solvent can be left behind in the product and can be dangerous for consumers. Steep Hill uses Gas Chromatography - Mass Spectrometry, along with Headspace Autosampling to quantitate residual solvents in manufactured cannabis products to ensure those products are free from solvents, or contain less than a specified limit. Our methodology and instrumentation are the most advanced used in the cannabis industry today. We currently screen for dozens of volatile compounds, including the following solvents: acetone, butane, ethanol, isobutane, isopropanol, methane, propane, pentane, and hexane, depending on location. Comprehensive solvent screening for manufactured cannabis products is offered for both R&D and compliance testing.

Steep Hill Services Cont'd

Testing services, including which instrumentation and testing specifications are used and followed, may vary from location to location

Microbial Analysis

Molds are ubiquitous, and trace amounts can be found in almost every cannabis sample. However, exposure to high levels of microorganisms such as molds and bacteria are known to cause health problems and can be particularly dangerous to patients that have existing medical conditions. The Steep Hill microbiological screening program ensures the safety of cannabis by identifying the type and amount of potentially dangerous microorganisms present in each sample. Cannabis that contains dangerous amounts of bacteria should be remediated or destroyed. Most states have established tolerance limits for microbiological contamination in cannabis. Microbiology testing may also be conducted via culturing or qPCR instrumentation, depending on location.

Foreign Matter Inspection

Quality cannabis products must not contain foreign contaminants, eg. hair, bugs, metal, etc., that would not be detected through other safety testing. Despite following strict hygiene and cleanliness protocols in production areas, these contaminants can sometimes make their way into products. Steep Hill provides foreign matter inspection via visual inspection to ensure your products are free from any foreign matter contamination that may have gone unnoticed during the cultivation or processing of your product.

Moisture Content Analysis

If your cannabis product contains too much moisture when it is packaged, it increases the risk of microbial growth and impacts shelf-stability of that product. Therefore, it is important to understand the moisture content of your product before packaging to reduce the potential risk of microbial growth and future product recalls. Steep Hill offers moisture content analysis by Loss on Drying, where the amount of water content is measured by using heat to evaporate off existing water, then comparing the original and final weight of the sample.

Water Activity Analysis

Water Activity analysis is performed to ensure your product's water activity level is at or below a specific threshold to reduce the risk of microbial growth while your product sits in its packaging. Ensuring your product's water activity level falls below this threshold provides confidence that the shelf-life of your product is maximized. At Steep Hill, water activity analysis is performed by measurement of water vapor in a Water Activity Meter.

Vitamin E Acetate

Vitamin E Acetate was thrust into the spotlight in 2019 when it was indicated as one of the potential culprits contributing to serious health repercussions related to unregulated vape product consumption. Steep Hill performs Vitamin E Acetate analysis by either HPLC, LC-MS or GC-MS, depending on location, to ensure your vape products do not have this potentially harmful ingredient in its formulation.

Homogeneity Testing

When manufacturing infused cannabis products, it is important to ensure that the active ingredients, most often cannabinoids, are evenly distributed throughout the product. Homogeneity testing with Steep Hill allows you to optimize your manufacturing process by indicating how evenly distributed your active ingredients are in your current product formulation. Homogeneity testing is performed by dividing a product unit into smaller portions, and performing potency testing on each portion to determine the consistency of cannabinoid distribution across each portion.

Hemp Analysis

As hemp production increases and the need for qualified input material grows, Steep Hill provides the testing and analysis services required to qualify the quality and safety of your hemp and hemp-derived products. Importantly, Steep Hill provides the ability to determine if your hemp falls below the 0.3% Total THC limit, as well, provides various additional services required to ensure the safety and quality of your product.

About Steep Hill

Founded in California in 2008, Steep Hill, Inc. is a science and technology firm that has become the industry leader in cannabis testing and analytics.

With labs in eight states, and a wholly owned sister lab in Toronto, Canada,
Steep Hill is the largest cannabis lab network in the world.

Steep Hill Inc. (CSE: STPH) is the world's leading cannabis science and technology company focused on laboratory testing, quality assurance, and data analytics. In 2008, Steep Hill opened the first commercial cannabis lab in the United States and has been on the cutting edge of cannabis testing since its inception. Steep Hill currently has operations throughout the United States and internationally. We are driven to offer service excellence while promoting "best practices" in cannabis testing. We're proud to consult with legislators and regulators in many countries, states and municipalities around the world on cannabis science, data analytics, and testing standards.

January 2008
Steep Hill opens the first Cannabis analytical lab in the U.S

June 2008
Steep Hill markets first marijuana potency test in California.

October 2008
Steep Hill creates first microbiological safety screen for cannabis

March 2009
Steep Hill Identifies first high-CBD strain in CA medical marijuana supply.

March 2011
Steep Hill develops QuantaCann™, the first remote instant on-site potency test

April 2013
Steep Hill hired by WA for regulatory consultation and method evaluation.

June 2013
Steep Hill merges with Halent Scientific

February 2014
Steep Hill licensee opens in CO for Amendment 64 regulatory testing.

March 2014
Steep Hill opens lab in Washington State for I-502 regulatory testing

November 2014
Steep Hill and U Tech Jamaica sign MoU opening 3-year partnership

February 2015
Steep Hill announces GenKit™ revolutionary new sex test for Cannabis breeders and growers

April 2015
QuantaCann2™ featured in CSI Las Vegas

June 2015
Steep Hill presents to CA Lt. Governor Newsom's Blue Ribbon Commission

September 2015
Steep Hill forms Genetic Research Alliance with University of Colorado

November 2015
Steep Hill's QuantaCann2™ is the official testing equipment for the High Times World Cannabis Cup in Jamaica

March 2016
Steep Hill launches "Operation Integrity" with the State of Washington's Liquor and Cannabis Board

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March 2017
Steep Hill signs partnership with PathogenDx to introduce revolutionary DNA-based testing

June 2018
Steep Hill Pennsylvania achieves ISO-17025 accreditation and opens lab for 3rd-party testing

May 2019
Steep Hill Arkansas achieves ISO-17025 accreditation and opens for 3rd-party testing

February/December 2020
Steep Hill Oklahoma opens for 3rd-party regulatory testing and achieves ISO-17025 accreditation

March 2021
Steep Hill Massachussets opens for 3rd-party regulatory testing

April/July 2021
Steep Hill signs licensing agreements for Steep Hill Mississippi and Steep Hill Illinois

January 2022
Steep Hill becomes a public entity - stock ticker (CSE:STPH)

April 2022
Steep Hill signs licensing agreement for Steep Hill Vermont

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Photography

Elizabeth Peace Photography
Pages 6, 9, 11, and 13.