INTERNATIONAL
WORKSHOP
AGREEMENT

IWA
37-1

First edition
2022-10

Safety, security and sustainability of cannabis facilities and operations —

Part 1:
Requirements for the safety of cannabis buildings, equipment and oil extraction operations

Reference number
IWA 37-1:2022(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

International Workshop Agreement IWA 37 was approved at a series of workshops hosted by the Standards Council of Canada (SCC), in association with Underwriters Laboratories of Canada (ULC), held virtually between December 2020 and June 2021.

A list of all parts in the IWA 37 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

While cannabis has been fully legalized in Canada and in many states in the US, it is a new and emerging industry that is moving at a very fast pace in many other parts of the world. While legalization is being deliberated by governments and legislative bodies, companies are creating their own infrastructure in anticipation of legal approval. Meanwhile, government regulators and the societies they serve are grappling with the lack of consistent rules and guidance to deliver safety, security and sustainability of cannabis facilities and operations, while growers and producers use their own judgment on how to establish and operate facilities.

It has become very clear that the global cannabis market is opening up very rapidly. The cannabis product and the industry will become more and more ubiquitous as the global barriers start to lower and come down. If the current trend continues, it is predicted that well over one third of the globe will accommodate cannabis by 2024.

What is unique about this new and emerging industry is that it is coming from an illicit status into decriminalization and evolving into a legitimate burgeoning business. Due to its pioneering status, very little exists in terms of research, studies, historical experience and best practices. Standardization is likewise very slow on the uptake and the cannabis industry remains severely underserved.

There are therefore distinct challenges for the safety, security and sustainability of cannabis facilities and operations, which the IWA 37 series seeks to address as follows:

- Part 1 (this document): Requirements for the safety of cannabis buildings, equipment and oil extraction operations;
- Part 2: Requirements for the secure handling of cannabis and cannabis products;
- Part 3: Good production practices (GPP).

In addition to the requirements for sites, facilities, buildings, and equipment specified in this document, statutory and regulatory requirements and codes can apply.

NOTE Annex A provides information on international construction codes to consider when working with this document.

Supporting material to accompany the IWA 37 series is available at the following website: IWA 37 — Safety, security and sustainability of cannabis facilities and operations.

A list of workshop participants is available from the Standards Council of Canada (SCC).

Safety, security and sustainability of cannabis facilities and operations —

Part 1:
Requirements for the safety of cannabis buildings, equipment and oil extraction operations

1 Scope

This document specifies a minimum level of protection and safety for buildings or parts thereof, which are used for the commercial cultivation, specific to processing of cannabis plants and cannabis products, and ancillary activities associated with cannabis plants and cannabis products.

This document specifies a minimum level of safety for the installation of devices, equipment, and systems used for cannabis cultivation, processing, and ancillary activities and addresses the risks of fire, electric shock, injury to persons, and explosion associated with these devices, equipment and systems.

This document includes minimum considerations for training of personnel and equipment maintenance.

This document specifies direction for the safe methods of extracting oil from cannabis plants, including but not limited to, initial extraction and post-processing refinement.

Where buildings or premises combine cultivation and processing of cannabis plants, including ancillary activities along with other operational activities, the requirements of this document are intended to apply to only that portion of the facility.

NOTE In many cases, a building or facility can be used for both the cultivation of cannabis plants and processing of cannabis products, along with a retail store front, call centre, or office administration space. Where such joint use activities are present in a common building, it is possible that local building or fire codes can require the installation or extension of certain life safety systems, such as fire alarm and fire sprinklers.

This document does not address the following:

- general building construction features that are normally a function of applicable codes;
- premises used exclusively for operational activities such as office space, call centres, and retail outlets, used for the distribution, marketing, or sale of cannabis;
- any use of the cannabis plant or cannabis products;
- the physiological or other attributes or effects that can result from the use of this equipment;
- the transportation of cannabis or cannabis related products;
- occupational health and safety requirements governing cannabis workers and personnel except as specifically identified in this document;
- security of the supply chain monitoring system, including cybersecurity and notifications;
- outdoor grow area (including cannabis and industrial hemp).

NOTE 1 Shipping and receiving of products from the production facility for further distribution are not considered as a retail outlet.

NOTE 2 This document is not intended to apply to facilities that are used exclusively for operational activities such as selling, marketing, or other business administrative purposes. This can include but not be limited to, retail rental space, call centres, or other facilities that are not combined with cultivation and ancillary activities associated with the growing, processing, and storage of cannabis plants and cannabis products.

All requirements in this document are generic and intended to be applicable to all organizations in the cannabis supply chain, regardless of size and/or complexity.

2 Normative references

The following documents are referred to in the text in such a way that some, or all, of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 834-1, *Fire-resistance tests — Elements of building construction — Part 1: General requirements*

ISO/TS 5658-1, *Reaction to fire tests — Spread of flame — Part 1: Guidance on flame spread*

ISO 6183, *Fire protection equipment — Carbon dioxide extinguishing systems for use on premises — Design and installation*

ISO 7240-14, *Fire detection and alarm systems — Part 14: Design, installation, commissioning and service of fire detection and fire alarm systems in and around buildings*

ISO 11625, *Gas cylinders — Safe handling*

ISO 13824, *Bases for design of structures — General principles on risk assessment of systems involving structures*

ISO 14520-1, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 1: General requirements*

ISO 16069, *Graphical symbols — Safety signs — Safety way guidance systems (SWGS)*

ISO 21542, *Building construction — Accessibility and usability of the built environment*

ISO 23601, *Safety identification — Escape and evacuation plan signs*

ISO 28802, *Ergonomics of the physical environment — Assessment of environments by means of an environmental survey involving physical measurements of the environment and subjective responses of people*

ISO 30061, *Emergency lighting*

IEC 60079-10-1, *Explosive atmospheres — Part 10-1: Classifications of areas — Explosive gas atmospheres*

IEC 60079-10-2, *Explosive atmospheres — Part 10-2: Classifications of areas — Explosive dust atmospheres*

IEC 60079-14, *Explosives atmospheres — Part 14: Electrical installations design, selection and erection*

IEC 62990-2, *Workplace atmospheres — Part 2: Gas detectors — Selection, installation, use and maintenance of detectors for toxic gases and vapours*

ANSI/CAN/UL/ULC 1389, *Standard for Safety, Plant Oil Extraction Equipment for Installation and Use in Ordinary (Unclassified) Locations and Hazardous (Classified) Locations*

NFPA 13, *Standard for the Installation of Sprinkler Systems*

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*

NFPA 1620, *Standard for Pre-Incident Planning*

UL 867A, *Outline for Commercial/Industrial Indoor Air Quality Systems, Ozone Generating Type*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
ancillary activity
activity conducted within the premises such as, but not limited to, drying, trimming, extraction, milling, processing and storage

3.2
authority having jurisdiction
AHJ
organization (3.29), office, or individual responsible for enforcing the *requirements* (3.36) of a code or standard, or for approving equipment, materials, an installation, or a procedure

Note 1 to entry: Also referred to as “competent authority”.

[SOURCE: ISO 7076-5:2014, 3.4, modified – Note 1 to entry has been added.]

3.3
cannabis
genus of flowering plants made up of many different phytocannabinoids and chemical compounds

Note 1 to entry: Research into cannabis by governing bodies and *organizations* (3.29) is ongoing around the world, and drug classifications are constantly under review. Regulation of cannabis legalization frameworks can vary between jurisdictions, based on the levels of tetrahydrocannabinol (THC) available in the plant.

3.4
cannabis derivative
secondary *product* (3.34) that can be extracted or obtained from a *cannabis* (3.3) biomass

Note 1 to entry: Classification of synthetically derived cannabinoids can vary between jurisdictions.

3.5
cannabis product
packaged goods containing *cannabis* (3.3) or *cannabis derivative* (3.4), available in multiple formats for commercial and/or retail distribution

3.6
closed-loop system
interconnected system of piping and vessels where solvent/process is contained within a closed system, not open to atmosphere while processing material

Note 1 to entry: Closed-loop systems operate at atmospheric pressure, under vacuum or under pressure.

3.7
combustible dust
finely divided solid particles, 500 µm or less in nominal size, which may form explosive mixtures with air at standard atmospheric pressure and temperatures

Note 1 to entry: This includes dust and grit as defined in ISO 4225.

Note 2 to entry: The term 'solid particles' is intended to address particles in the solid phase but does not preclude a hollow particle.

[SOURCE: ISO/IEC 80079-20-2:2016, 3.1]

3.8
combustible liquid
liquid having a flash point at or above 37,8 °C and below 93,3 °C

3.9
competence
ability to apply knowledge and skills to achieve intended results

[SOURCE: ISO 22000:2018, 3.4]

3.10
contamination
introduction or occurrence of a contaminant including a *safety hazard* (3.39) in a *product* (3.34) or processing environment

[SOURCE: ISO 22000:2018, 3.6]

3.11
crude oil
oil that has been extracted from a *cannabis* (3.3) plant biomass that can undergo further refinement

3.12
crystallization
process (3.33) of purifying a chemical substance; or the formation of solid forms or a crystal via organized structures of atoms/molecules

Note 1 to entry: The formation of crystals in a solution is known as precipitation; which can be triggered by changes in temperature and/or pressure resulting in nucleation and ultimately crystal growth.

3.13
cultivation
process (3.33) of growing *cannabis* (3.3), including drying, trimming, milling, and storing

3.14
decarboxylation
chemical reaction using temperature and time that removes a carboxyl group and releases carbon dioxide

3.15
dewar vessel
glass or metal container designed like a vacuum bottle typically used for storing liquefied gases

3.16
distillation
further refinement of the cannabinoid extract involving the application of heat and vacuum to target different boiling points of compounds so as to remove impurities and increase the active compound potency of the extract

Note 1 to entry: Short path bench top apparatuses or wiped and rolled film evaporators are examples of common distillation equipment.

3.17
extraction
process (3.33) where a substance is removed or separated from other compounds, a solution or a mixture

3.18
filtration
process (3.33) of separating suspended solid matter from a liquid via a physical, biological, or chemical filter medium that only allows liquid to pass through

Note 1 to entry: The resulting fluid is called the filtrate, which will contain a reduced concentration of the targeted solid matter trapped behind the filter medium.

3.19
flammable gas
substance that exists in the gaseous state at normal atmospheric temperature and pressure and is capable of being ignited and burned when mixed with the proper proportions of air, oxygen or other oxidizers

3.20
flammable liquid
liquid having a flash point below 37,8 °C and having a vapour pressure not more than 275,8 kPa (absolute) at 37,8 °CNote 1 to entry: The standard test method for vapour pressure of petroleum *products* (3.34) is the Reid Method, as determined by ASTM D323.

3.21
flammable solvent
flammable liquid, *combustible liquid* (3.8) or a flammable gas capable of dissolving another substance to form a uniformly dispersed mixture at the molecular or ionic level

3.22
food
substance (ingredient), whether processed, semi-processed or raw, which is intended for consumption, and includes drink, chewing gum and any substance which has been used in the manufacture, preparation or treatment of “food” but does not include cosmetics or tobacco or substances (ingredients) used only as drugs

[SOURCE: ISO 22000:2018, 3.18, modified — The original Note to entry has been deleted.]

3.23
greenhouse
building that can have unlimited size, and with more than 50 % of surface area of roofs and/or walls being transparent and/or translucent for the *cultivation* (3.13) of *cannabis* (3.3) plants and other cultivation activities

3.24
grow area
area of the site where *cannabis* (3.3) plants are cultivated, harvested or propagated

3.25
lab scale operation
small scale processing, typically less than commercially viable scale in a given industry

Note 1 to entry: Small quantities of material are processed in these operations, which are often used for research and development and/or proof of concept for pilot, demonstration, or industrial-scale viability. The containers used for reactions, transfers, and other handling of chemicals are typically designed to be easily and safely manipulated by one person.

3.26
lower flammable limit
LFL
concentration of a flammable gas or vapour in air, below which an explosive gas atmosphere does not form

[SOURCE: ISO/IEC 80079-20-1:2017, 3.6.1, modified — The notes to entry have been deleted.]

3.27
monitoring
determining the status of a system, a *process* (3.33) or an activity

Note 1 to entry: To determine the status, there may be a need to check, supervise or critically observe.

Note 2 to entry: In the context of *cannabis* (3.3) *safety* (3.38), monitoring is conducting a planned sequence of observations or measurements to assess whether a process is operating as intended.

Note 3 to entry: Distinctions are made in this document between the terms *validation* (3.40), monitoring and *verification* (3.41):

- validation is applied prior to an activity and provides information about the capability to deliver intended results;
- monitoring is applied during an activity and provides information for action within a specified time frame;
- verification is applied after an activity and provides information for confirmation of conformity.

[SOURCE: ISO 22000:2018, 3.27, modified — The words "food safety" have been replaced with "cannabis safety" in Note 2 to entry.]

3.28
non-polar solvent
flammable liquid or flammable gas that does not readily mix with water without the use of chemical additives, such as emulsifying agents.

Note 1 to entry: Flammability is a concern at all concentrations in both liquid and gaseous phases.

Note 2 to entry: Non-miscible flammable liquids (often referred to as non-polar solvents) are oils (vegetable and petroleum based) and flammable petroleum gases. Petroleum based compounds can include liquids such as naphtha, gasoline etc. as well as gases such as butane, propane (LPG) etc.

3.29
organization
person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives

Note 1 to entry: The concept of organization includes, but is not limited to sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

[SOURCE: ISO 22000:2018, 3.31]

3.30
personal protective equipment
PPE
device or appliance designed to be worn by an individual for protection against one or more health and *safety hazards* (3.39)

Note 1 to entry: PPE includes, but is not limited to, gowns, gloves, respirators, safety glasses, helmets, and goggles.

Note 2 to entry: While generally not considered PPE, masks (and face coverings) can provide a level of protection for the user, in addition to their primary purpose as a public health measure to control the spread of transmission and infection.

Note 3 to entry: National regulations can apply with respect to PPE.

[SOURCE: ISO 15384:2018, 3.12, modified — The words "or held" have been removed from the definition and the Notes to entry have been added.]

3.31
polar solvent
flammable liquid that mixes in all proportions with water at standard temperature and pressure without the use of chemical additives, such as emulsifying agents

Note 1 to entry: Water miscible flammable liquids (often referred to as polar solvents) are typically alcohol, acetone or ketone-based liquids.

Note 2 to entry: As an example, beverages containing ethanol such as beer and wine will have an alcohol volume concentration (ABV) of less than 20 % and are not seen as a special fire protection hazard. Spirits will have greater than 20 % ABV and are seen as a special hazard with the *risk* (3.37) level increasing proportionately with concentration.

3.32
post-processing
process (3.33) that occurs after the initial plant oil extraction process, when the concentrate is manufactured into food, vape cartridges, capsules, and different consumer packaged goods

3.33
process
set of interrelated or interacting activities which transforms inputs to outputs

[SOURCE: ISO 22000:2018, 3.36]

3.34
product
output that is a result of a *process* (3.33)

Note 1 to entry: A product can be a service.

[SOURCE: ISO 22000:2018, 3.37]

3.35
protected area
protected premises, or an area within, that is provided with means to prevent an unwanted event

Note 1 to entry: Protected areas are imposed in the low security level.

3.36
requirement
need or expectation that is stated, generally implied or obligatory

Note 1 to entry: "Generally implied" means that it is custom or common practice for the *organization* (3.29) and interested parties that the need or expectation under consideration is implied.

Note 2 to entry: A specified requirement is one that is stated, for example in documented information.

[SOURCE: ISO 22000:2018, 3.38]

3.37
risk
effect of uncertainty

Note 1 to entry: An effect is a deviation from the expected – positive or negative.

Note 2 to entry: Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of, an event, its consequence, or likelihood.

Note 3 to entry: Risk is often characterized by reference to potential "events" (as defined in ISO Guide 73:2009, 3.5.1.3) and "consequences" as defined in ISO Guide 73:2009, 3.6.1.3), or a combination of these.

Note 4 to entry: Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated "likelihood" (as defined in ISO Guide 73:2009, 3.6.1.1) of occurrence.

[SOURCE: ISO 22000:2018, 3.39, modified — The original Note 5 to entry has been deleted.]

3.38
safety
assurance that the *product* (3.34) will not cause an adverse health effect for the consumer when it is prepared and/or used according to its intended use

Note 1 to entry: Safety is related to the occurrence of *safety hazards* (3.39) in end products and does not include other health aspects.

3.39
safety hazard
source or situation with the potential to cause an adverse health effect

Note 1 to entry: The term hazard is not to be confused with the term *risk* (3.37) which, in the context of *safety* (3.38), means a function of the probability of an adverse health effect (e.g. becoming diseased) and the severity of that effect (e.g. death, hospitalization) when exposed to a specified hazard.

Note 2 to entry: Safety hazards include allergens and radiological substances.

[SOURCE: ISO 22000:2018, 3.22, modified — The word "food" has been deleted from the term and from Notes 1 and 2 to entry; the words "biological, chemical or physical agent in food" have been replaced with "source or situation" in the definition; the original Notes 3 and 4 to entry have been deleted.]

3.40
validation
obtaining evidence that a control measure (or combination of control measures) will be capable of effectively controlling the significant *safety hazard* (3.39)

Note 1 to entry: Validation is performed at the time a control measure combination is designed, or whenever changes are made to the implemented control measures.

Note 2 to entry: Distinctions are made in this document between the terms validation, *monitoring* (3.27) and *verification* (3.41):

- validation is applied prior to an activity and provides information about the capability to deliver intended results;
- monitoring is applied during an activity and provides information for action within a specified time frame;
- verification is applied after an activity and provides information for confirmation of conformity.

[SOURCE: ISO 22000:2018, 3.43, modified — The word "food" has been deleted from the definition.]

3.41
verification
confirmation, through the provision of objective evidence, that specified *requirements* (3.36) have been fulfilled

Note 1 to entry: Distinctions are made in this document between the terms *validation* (3.40), *monitoring* (3.27) and verification:

- validation is applied prior to an activity and provides information about the capability to deliver intended results;
- monitoring is applied during an activity and provides information for action within a specified time frame;
- verification is applied after an activity and provides information for confirmation of conformity.

[SOURCE: ISO 22000:2018, 3.45]

3.42
winterization
fractionation *process* (3.33) that uses a solvent and cold temperatures to separate lipids and other undesired constituents

4 Buildings

4.1 General

4.1.1 This clause addresses facilities used for the cultivation, production, processing, or combination thereof, of cannabis.

NOTE Additional information can be found in CAN/ULC-S4400 and ANSI/CAN/UL/ULC 1389.

4.1.2 The buildings or parts thereof addressed in this document can be classified as any of the following:

a) industrial;

b) commercial;

c) agricultural;

d) farm building;

e) any combination of a) to d).

4.1.3 Cannabis extraction processes using flammable solvents shall not be conducted within a building containing any of the following occupancies:

a) assembly;

b) detention;

c) treatment or care;

d) residential.

4.1.4 Buildings and facilities or parts thereof, that are used for ancillary activities, related to the cultivation, production, processing or storage of cannabis and cannabis related products, shall be classified in accordance with their occupancy.

NOTE 1 Other building and occupancy classifications can be identified by applicable codes and regulations, or by the authority having jurisdiction (AHJ).

NOTE 2 Occupancies are classified in accordance with local codes and regulations where these exist. In their absence users of this document can reference other internationally recognized documents, e.g. NFPA 5000, ICC International Building Code[22], National Building Code of Canada[23].

4.2 Building design

4.2.1 The processing of cannabis, including extraction activities, shall be carried out in building occupancies, or portions thereof, approved for such use.

NOTE Plant oil extraction processes using flammable solvents can result in the release of flammable vapours into the surrounding atmosphere as a normal part of the overall extraction process. As a result, it is important that such areas within a building are designed accordingly.

4.2.2 All areas that will involve the storage or use of flammable solvents, such as, but not limited to: shipping/receiving areas, storage areas, extraction spaces, refinement spaces, and finished product holding areas, shall be carried out in occupancies approved for such use.

4.2.3 Areas within a building housing the storage or use of flammable solvents should be designed to include the following building construction features:

a) fire compartments constructed of fire separations that provide a specific fire-resistance rating;

b) mechanical ventilation systems;

c) spill control and containment systems;

d) fire suppression systems;

e) flammable gas detection systems;

f) explosion control or prevention systems;

g) egress and exiting systems;

h) emergency power systems.

4.2.4 Indoor grow areas shall be separated from the remainder of the building by wall assembly(s) having a fire resistance rating not less than one hour as determined by ISO 834-1.

NOTE The requirement for a 1 h fire separation between the indoor grow area and the remainder of the building is intended to allow a fire alarm system to serve only a portion of the building (with minimal openings for wiring and piping), as permitted by local codes, regulations and standards. Separating the indoor grow area of a cannabis facility from the remainder of the building by a 1 h fire separation safely allows for the fire alarm system requirements to be applied to the building without needing to extend the fire alarm system to the indoor grow area, unless required due to the number of occupants and/or level of fire hazard risk.

4.2.5 Rooms used for carbon dioxide extraction or storage shall be designed for the purpose and approved for such use.

4.2.6 Repurposing of existing buildings, including portions of buildings that are being considered for activities related to the cultivation, production, processing, or storage of cannabis and cannabis related products, shall be approved for such use.

NOTE 1 Where an existing building, or portion thereof, is being considered, an evaluation in consultation with a design professional is conducted to determine if the intended activities suit the existing facility occupancy classification and building construction.

NOTE 2 Not all existing facilities have sufficient sprinkler system capacity, firefighting water supply, fire department access, roof construction, or sufficient construction systems that are adequate for the new building occupancy classification and modifications are sometimes required for them to be suitable for use.

NOTE 3 Existing portions of a building that are not directly undergoing renovation can be permitted to remain as-is only where the renovations do not result in a reduction in the performance of fire protection and life safety systems.

4.3 Fire protection systems

4.3.1 Where a fire alarm system is installed, it shall be installed in accordance ISO 7240-14.

NOTE If a farm building or greenhouse is provided with openings that permit access between the grow area and the rest of the building, then the fire alarm system is not necessarily required to extend to the grow area. Specific AHJ requirements can apply.

4.3.2 Where a portion of a building requires a fire alarm system, a means of signalling shall be provided in the unprotected area at each access point between the protected and unprotected areas.

NOTE Potential solutions for signalling between the protected and unprotected areas include, but are not limited to, audible and visible signalling, alarm, horn, or Fire-Do-Not-Enter signs to prevent access to and through the affected area. Specific AHJ requirements can apply.

4.3.3 Where a fire suppression system is installed, it shall be installed in accordance with one of the following:

a) an automatic water sprinkler system that meets all applicable requirements of NFPA 13;

b) a carbon dioxide extinguishing system that meets all applicable requirements of ISO 6183;

c) a dry chemical extinguishing system that meets all applicable requirements of NFPA 17;

d) a gaseous agent extinguishing system that meets all applicable requirements of ISO 14520-1;

e) a water spray fixed system that meets all applicable requirements of NFPA 15;

f) any other suppression system acceptable to the AHJ.

4.4 Means of egress

4.4.1 Means of egress shall comply with ISO 21542.

4.4.2 Where required, all exit doors shall be marked in accordance with ISO 23601.

4.4.3 Secure doors equipped with an electric locking device, which impede egress, shall release upon activation of a fire alarm system.

4.4.4 Secure doors which impede egress shall be equipped with a panic hardware device or a security monitoring system shall be installed with the ability to unlock the door.

4.4.5 Where a safety way guidance system is provided and installed, it shall be in accordance with ISO 16069.

4.5 Emergency lighting

Where required, areas shall have emergency lighting in accordance with ISO 30061.

NOTE Emergency lighting can compromise the grow cycle of plants. It is important to consider the impact of emergency lighting levels on plant growth in cultivation areas.

4.6 Notification and signage

4.6.1 Warning signs specifying a danger or caution signs specifying a hazard, shall be prominently posted on or near doors and entrances to the building, including interior rooms and areas.

4.6.2 Warning signs clearly indicating areas of potential entrapment hazard; shall be provided.

NOTE Additional information is given in ISO/TS 20559.

4.6.3 Directional signs leading to an open space protected from fire exposure from the building shall be provided.

NOTE The intent of this clause is to provide signage directing persons to a safe place outside of the building in case of a fire or other emergency condition requiring evacuation of the building. These areas are also known as muster areas.

4.6.4 Emergency controls, disconnecting means, and devices shall be clearly labelled for their use.

4.6.5 Posting of emergency measures shall be in accordance with ISO 23601.

4.7 Safety and hazard assessment

4.7.1 Where an emergency response plan is required, it shall be prepared in accordance with ISO 13824.

4.7.2 An occupational health and safety plan shall be implemented, e.g. in accordance with ISO 45001.

4.7.3 Where required, pre-incident planning shall be developed by (a) qualified person(s) in cooperation with the local fire department or brigade in accordance with NFPA 1620.

4.8 Exhaust and ventilation

4.8.1 Building exhaust and ventilation systems shall be designed, installed, and operated to handle specific needs such as but not limited to:

a) indoor air quality;

b) hazardous vapour capture;

c) odour mitigation;

d) environmental control.

4.8.2 Where areas within a building require ventilation for indoor air quality, they shall be assessed in accordance with ISO 28802.

NOTE Exhaust from extraction rooms and enclosures where dangerous goods, vapours or particles are present are to be exhausted to the exterior and not recirculated into the building. Additional information is given in ASHRAE 62.

4.8.3 The building or part of the building where cannabis is cultivated and ancillary activities are conducted, shall be equipped with a system that filters air to prevent the escape of odours.

4.8.4 Where flammable solvents are used as part of the plant oil extraction process or ancillary activities, the building or portion thereof shall be provided with the following:

a) a ventilation system to prevent flammable gas/vapour concentrations from exceeding 25 % of the lower explosive limit (LEL);

b) a flammable gas/vapour detection system in the area where such gases can be present that is suitable for detecting the types of gases used.

NOTE Extraction booths manufactured in accordance with ANSI/CAN/UL/ULC 1389 include requirements for ventilation and exhaust, electrical equipment, and gas detection.

4.9 Processing rooms

4.9.1 Areas within a building that are subject to moisture in the form of vapour and liquid in quantities that are liable to interfere with electrical equipment such as areas being hosed down, sanitized, or where high humidity occurs, shall be classified for this environment.

4.9.2 Ancillary activities using flammable solvents shall be conducted in rooms that are constructed with wall assemblies having a fire-resistance rating appropriate to separate the solvent hazard from adjacent areas and occupancies.

4.9.3 Areas intended for plant oil extraction where flammable solvents are used shall be evaluated according to IEC 60079-10-1 to define potentially hazardous areas.

NOTE Items for consideration in the determination of hazardous areas can include the following:

a) the extent of the area classification associated to the specific process(es) and site conditions;

b) the terminology associated to hazardous locations that can include similar terms as those used for Safety Data Sheets (SDS) hazardous substance classifications or occupancy classifications but have a different meaning;

c) the solvent properties and how they affect the hazardous area.

4.9.4 Where an automatic suppression system within extraction rooms, booths, hoods, or enclosures, including ductwork, is installed, it shall be in accordance with 4.3.3.

4.9.5 Cannabis extraction processes using carbon dioxide or other non-hazardous substances shall be conducted in a room designed for that purpose.

4.9.6 Areas where plant drying, and processing generates combustible dust shall be evaluated according to IEC 60079-10-2 to define potentially hazardous areas.

4.9.7 Appropriate measures shall be taken to minimize the risk of explosion or fire hazards in the design of facilities where plant drying, and processing activities are capable of generating combustible dusts.

4.9.8 Equipment used in hazardous areas shall be approved for the location.

NOTE Annex A includes information regarding area classification, hazardous material classification, temperature class, electrical equipment for use in explosive atmosphere design principles, marking of equipment for use in hazardous areas, gas groups and suitability of electrical equipment for a location.

4.10 Storage

4.10.1 Areas within a facility where hazardous substances are stored shall be designed in accordance with the applicable regulations, or in their absence good engineering practice.

NOTE Hazardous substances can include, but are not limited to, the following:

a) flammable solvents:

b) compressed gas cylinders;

c) waste products;

d) pesticides;

e) ammonium nitrate;

f) chemical agents.

4.10.2 The volume of materials stored shall be considered when determining the fire protection requirements for areas identified in 4.10.1.

4.10.3 Flammable solvents shall not be stored in quantities exceeding the supply necessary for normal operation in the same room where extraction occurs.

NOTE It is important to consider occupational exposure limits when handling chemicals.

4.11 Interior

Movable partitions and temporary wall dividers installed as part of the interior finish of an area shall not interfere with the fire protection system and shall have a flame spread rating as determined by ISO/TS 5658-1.

NOTE Specific AHJ requirements can apply.

5 Devices and equipment

5.1 General

5.1.1 This clause applies to the installation of electrical, gas, plumbing, fire, pressure equipment and vessels, mechanical and HVAC equipment, and other devices and systems.

5.1.2 The installation, operation and maintenance of equipment, devices, and systems shall be in accordance with the manufacturer's instructions.

NOTE 1 Annex A includes information regarding area classification, hazardous material classification, temperature class, electrical equipment for use in explosive atmosphere design principles, marking of equipment for use in hazardous areas, gas groups and the suitability of electrical equipment for a location.

NOTE 2 Users of this document can consider the manufacturer's suggested best practices for removal and decommissioning of equipment and systems. The purpose of decommissioning and removing equipment is to ensure that equipment and support systems are removed in accordance with the manufacturer's instructions and recommendations, codes, and regulations where applicable, or in their absence, in accordance with good engineering practices. This process ensures the lowest possible risk to employees, the facility, operations, or maintenance activities. Appropriate personal protective equipment (PPE) is worn when decommissioning and removing equipment.

5.2 Ventilation control equipment

5.2.1 The flammable gas vapour detection system referenced in 4.8.4 shall:

a) be installed in accordance with the manufacturer's instructions;

b) provide an indication when gas levels reach 10 % of the LEL and a distinct audible or visual alarm when the gas level reaches 25 % of the LEL;

c) comply with the requirements of IEC 62990-2.

5.2.2 Where ozone generating equipment is used for odour control, the equipment shall comply with UL 867A.

5.3 Carbon dioxide use

5.3.1 The safe handling, use and storage of gas cylinders shall comply with ISO 11625.

NOTE Additional information involving the installation of compressed or liquefied carbon dioxide in portable and stationary cylinders, can be found in NFPA 55.

5.3.2 Carbon dioxide pressure vessels shall be equipped with pressure relief devices such as rupture disks or spring-loaded valves.

All pressure relief devices shall be vented to move carbon dioxide gas to the exterior of the building envelope in case of device activation. Carbon dioxide release points need to be in a safe and acceptable location.

5.3.3 Carbon dioxide gas detection systems shall be installed when carbon dioxide is used in cultivation or processing and be installed in accordance with the manufacturer's instructions.

5.3.4 Where carbon dioxide is being used for enrichment and growth control, carbon dioxide generators specifically designed for the purpose shall be used.

5.3.5 Where carbon dioxide atmospheric enhancement is achieved using a fuel burning appliance, carbon monoxide detection or alarm device(s) shall be provided.

5.3.6 Where fuels are burned in greenhouses, separate combustion air and flue systems shall be provided except where the system is specifically designed as a generator for carbon dioxide enrichment of the greenhouse atmosphere.

5.3.7 Carbon dioxide and carbon monoxide detection systems shall comply with the requirements of IEC 62990-2.

5.3.8 Carbon dioxide and carbon monoxide detection systems shall provide a warning or an alarm when carbon monoxide or carbon dioxide levels exceed occupational exposure standards.

NOTE 1 Where gas detection systems are installed, they are interlocked with building ventilation systems to exhaust the contaminated air with no recirculation of exhaust into the building.

NOTE 2 As the concentration carbon dioxide in air rises, it can cause headaches, dizziness, confusion, and loss of consciousness. At 40 000 ml/m^3 it is immediately dangerous to life and health. Where carbon dioxide is used in cultivation or processing, the employer conducts a risk assessment of the exposure or likelihood of exposure of a worker to carbon dioxide in the workplace and records it in writing. In carrying out the assessment, the employer considers the following:

— the methods and procedures used or to be used in the processing, use, handling, and storage of carbon dioxide;

— the extent and potential extent of a worker's exposure to carbon dioxide during routine operations and during a process failure that can lead to an unexpected release of carbon dioxide;

— the measures and procedures that are necessary to control exposure to carbon dioxide by means of engineering controls, work practices and hygiene facilities and practices;

— the appropriate spacing of detectors in the facility.

Where rooms are used for carbon dioxide extraction or storage, gas detection and alarm systems are installed to provide warnings to occupants if carbon dioxide levels exceed 5 000 ml/m^3.

NOTE 3 As carbon monoxide levels increase and remain above 50 ml/m^3, symptoms can become more noticeable (such as headache, fatigue, nausea). As carbon monoxide levels increase above 150 ml/m^3 to 200 ml/m^3, disorientation, unconsciousness, and death are possible. Users of this document can review local occupational health and safety standards, in consultation with the local authorities, regarding worker exposure levels to carbon monoxide and carbon dioxide to establish an acceptable setpoint for these monitoring systems.

5.4 Plant drying and processing equipment

5.4.1 Equipment for use in plant drying and processing areas where explosive dust atmospheres have been identified shall be approved for the location. See A.4.

NOTE Additional information regarding explosive dust atmospheres is given in IEC 60079-10-2.

5.4.2 The equipment described in 5.4.1 shall be installed in accordance with IEC 60079-14.

6 Oil extraction

6.1 General

6.1.1 This clause relates to the extraction of plant oil using hazardous solvents.

6.1.2 Hazardous solvents include, but are not limited to: butane, propane, ethanol, pentane, or carbon dioxide.

6.1.3 Hazardous processing conditions include, but are not limited to: combustibility, flammability, pressure, and toxic or asphyxiating atmospheres.

6.1.4 Gaskets and fittings shall be compatible with the types of solvent(s) used, and for the temperature and pressure ranges anticipated during the extraction process.

NOTE Annex A includes information regarding area classification, hazardous material classification, temperature class, electrical equipment for use in explosive atmosphere design principles, marking of equipment for use in hazardous areas, gas groups and the suitability of electrical equipment for a location.

6.2 Building, equipment, and process integration

The selection and use of solvents, extraction equipment, equipment ratings, quantities of hazardous materials and processes shall be considered when determining the appropriate building classification, design, and protection as outlined in Clause 4.

6.3 Identification of risks and hazards

6.3.1 This subclause is intended to assist the user in identifying inherent risks associated with solvent use and provides recommendations to mitigate their impact.

Additional information regarding hazards associated with plant oil extraction, and post-processing refinement, including fire, explosion, toxic materials exposures, physical, and health hazards is given in Table 1. See 6.7, 6.10 and 6.15

Table 1 — Risks and hazards: Initial extraction

Risk	Hazard	Process				
		Hydrocarbon	**Carbon dioxide**	**Alcohol**	**Microwave assisted extraction**	**Mechanical separation processing**
Pressurized vessels	Rupture	✓	✓	×	✓	×
	Explosion	✓	✓	×	✓	×
Pressurized hose connection	Connection failure	✓	✓	✓	✓	✓
	Flailing hoses	✓	✓	×	×	×
Burns	Flash burns	✓	×	×	×	×
	Cryogenic burns	×	✓	×	×	✓
	Surface temperature	✓	✓	✓	✓	✓
Fire or explosion	Flammable solvent	✓	×	✓	✓	×
	Combustible solvent	✓	×	×	✓	×
Ignition source	Co-solvent	×	✓	×	×	×
	Flammable solvent	✓	✓	✓	✓	×
	Particulate contaminant	✓	✓	✓	✓	✓
Toxicity and asphyxiation	Solvents: Chemicals	✓	✓	✓	✓	×
	Solvents: Leaks	✓	✓	✓	✓	×
Oxygen displacement	Carbon dioxide exposure	×	✓	×	×	×
Environment and personnel safety	Sharp objects	✓	✓	✓	✓	✓
	Wet floors	✓	✓	✓	✓	✓
	Trips/falls	✓	✓	✓	✓	✓
	Heavy objects	✓	✓	✓	✓	✓
	Temperature rated equipment	✓	✓	✓	✓	✓
	Labelling of hot/cold surfaces	✓	✓	✓	✓	✓
	Heat ventilation	✓	✓	✓	✓	✓

6.3.2 Equipment, such as heaters, chillers, vacuum pumps, and air compressors used for the extraction process, shall not be located within the extraction room unless designed or approved for that location. See also 4.9.

6.3.3 Properties of the flammable gas or vapour that can be present shall be considered when determining the suitability of the equipment for the specific extraction process.

6.4 Hazard mitigation

6.4.1 An assessment of the hazards associated with the processing of cannabis shall be conducted and a, hazard mitigation plan shall be developed accordingly. See 4.7.

6.4.2 The process hazard mitigation plan shall include a hierarchy of controls to minimize exposures to occupational hazards which are essential for protecting personnel.

Traditionally, a hierarchy of controls has been used as a means of determining how to implement feasible and effective control solutions.

One representation of this hierarchy is shown in Figure 1.

NOTE The idea behind this hierarchy is that the control methods at the top of graphic are potentially more effective and protective than those at the bottom.

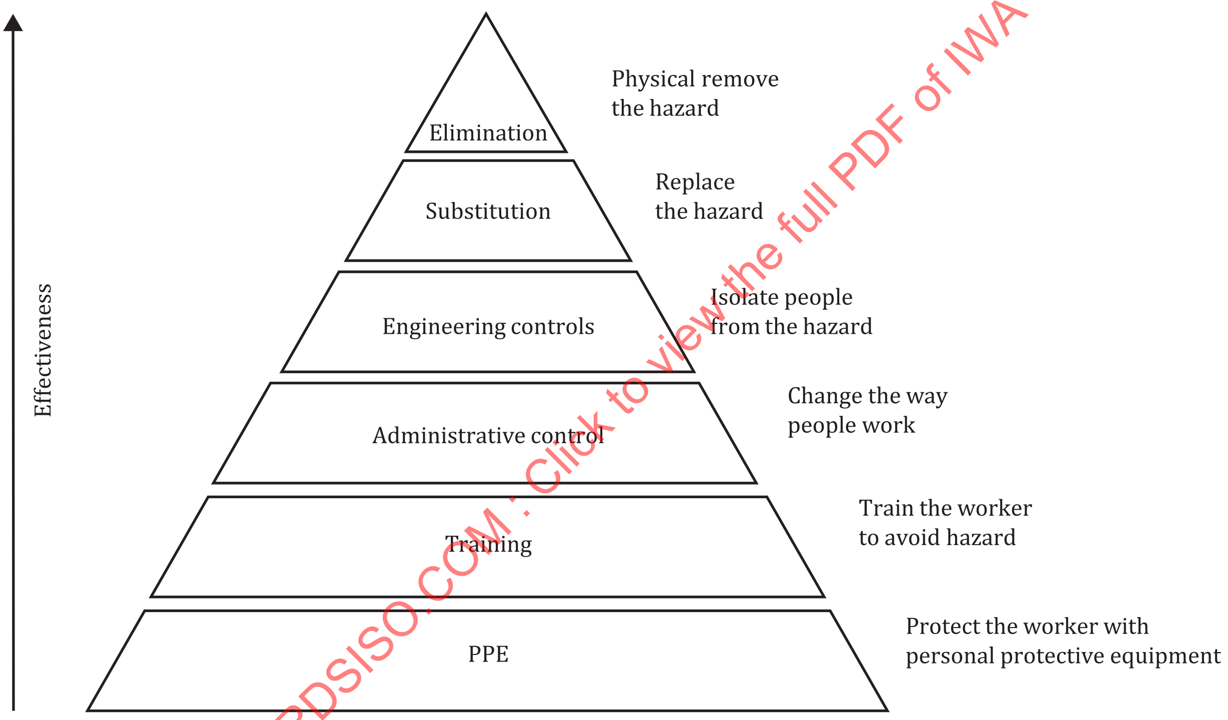

Figure 1 — Hierarchy of controls

Following this hierarchy normally leads to the implementation of inherently safer systems, where the risk of illness or injury has been substantially reduced.

6.4.3 When using chemicals or solvents the appropriate PPE shall be worn.

6.4.4 Fire-resistant PPE shall be worn when working with flammable solvents.

6.5 Waste disposal

6.5.1 Initial extraction and post-processing methods can produce different active wastes that require specialized consideration. Examples can include but are not limited to:

a) contaminated biomass;

b) lipids;

c) brine solution;

d) condensates.

6.5.2 All active waste or volatile fraction condensates shall be rendered inert before being disposed of.

6.5.3 All active waste shall be considered as hazardous and appropriate waste disposal system shall be used.

6.6 Initial extraction methods and processes

6.6.1 Extraction is the removal of targeted compounds from biomass. This subclause reviews various initial extraction methods using a solvent, and their operational intent.

Initial extraction is the first step in the entire processing chain, and all steps in post-processing are dependent on it.

6.6.2 Rooms and areas used for initial extraction can present known fire and explosion hazards.

Systems, equipment, and areas shall be rated appropriately to prevent ignitions, fires, and explosions as defined in other clauses of this document.

NOTE Further information on extraction equipment is given in ANSI/CAN/UL/ULC 1389.

6.6.3 Closed-loop systems and centrifuged-based machines are used in the extraction process.

NOTE 1 Closed-loop systems and centrifuge-based machines are designed to mitigate the risk of pressurized solvents and solvent release and exposure.

NOTE 2 Closed-loop systems can operate at pressures in excess of 34 474 kPa (5 000 psi).

6.6.4 Examples of pressurized systems and components thereof can include, but are not limited to:

a) extraction vessels;

b) extracted oil separator vessels;

c) compressors and pumps;

d) lines, pipes, manifolds, pressure regulators, and hoses;

e) storage tanks,

NOTE Additional information is given in ISO 16528-1.

6.7 Hydrocarbon extraction

6.7.1 Hydrocarbon extraction primarily uses butane, iso butane, propane, hexane, or heptane depending on the size of the operation.

6.7.2 Instrument grade solvent shall be used for extraction due to contaminants found in non-instrument grade solvents.

6.7.3 See Table 1.

6.8 Hydrocarbon extraction process flow

6.8.1 Hydrocarbons are used at various temperatures and pressures, and then they are condensed and reclaimed during the extraction process.

6.8.2 Hydrocarbon solvent is introduced into the biomass, creating a solution consisting of hydrocarbon solvent and constituents from the plant and routed to a collection vessel in the closed-loop system.

6.8.3 Heat transfer fluid is used within the collection vessel jacket to provide heat. The low amounts of heat on this jacket serve two purposes:

a) to evaporate the liquid hydrocarbon solvent out of the solution;

b) to counterbalance the thermodynamic reaction of evaporative cooling caused by the hydrocarbon solvent converting states from a liquid to a vapour.

These basic thermodynamic concepts are used to execute the extraction cycle.

6.8.4 Normally a pneumatic recovery pump, or an electric recovery pump is used to recover the solvent vapour evaporated in the collection vessel and begin compressing the solvent back to its liquid form.

This liquid is warm due to the heat generated from compressing the vapour, which can boost discharge pressures from the pump.

To counteract this, the warm liquid is routed through a jacketed heat exchanger powered by a suitable chiller. The heat exchangers jacket absorbs the thermal load and keeps discharge pressures low.

6.8.5 Prior to waste disposal, the spent biomass shall be off gassed in a ventilated area for the purpose of removing residual flammable vapours.

NOTE 1 Biomass feed materials are often placed in mesh fabric bags or socks and then placed into solvent to remove oils from the plant material. After the liquid is separated from the bag or sock, the biomass is degassed and any residual solvent to evaporate from the spent feed. Solvent permitted to evaporate into the air in an uncontrolled manner can present serious fire and explosion hazards. Handling of spent biomass following the extraction of oils using a flammable solvent takes special considerations. When removing the spent biomass from the column after extraction, there is an increased risk for the release of solvent vapour into the atmosphere due to residual amounts of solvents in the spent biomass. It is probable that most of the solvent has been removed and recovered in the process; however significant amounts of solvent can remain trapped in the spent biomass. Proper off-gassing procedures are conducted to minimize the risk of hazardous flammable organic waste. Degassing of spent biomass is done within a suitable ventilated enclosure, booth, hood, or room to exhaust potentially flammable vapours from the building.

NOTE 2 Additional information can be found in NFPA 91.

6.8.6 Pumps used with hydrocarbon-based extraction systems shall conform to ANSI/CAN/UL/ULC 1389 and can include the following.

a) Pneumatic pumps: These are recovery pumps that use compressed air as their power source. This style of pump does not require any electrical connections as they are powered with compressed air.

b) Electric pumps: These are recovery pumps that use electricity as their power source.

6.8.7 Passive recovery is an alternate method using thermodynamic concepts, that does not use a pump, to recover solvents.

NOTE This is achieved by creating a warm environment in the collection vessel to evaporate solvent, and a much colder environment within the solvent operating tank to create a natural push/pull and evaporation/condensation effect.

Figure 2 illustrates the hydrocarbon extraction process flow.

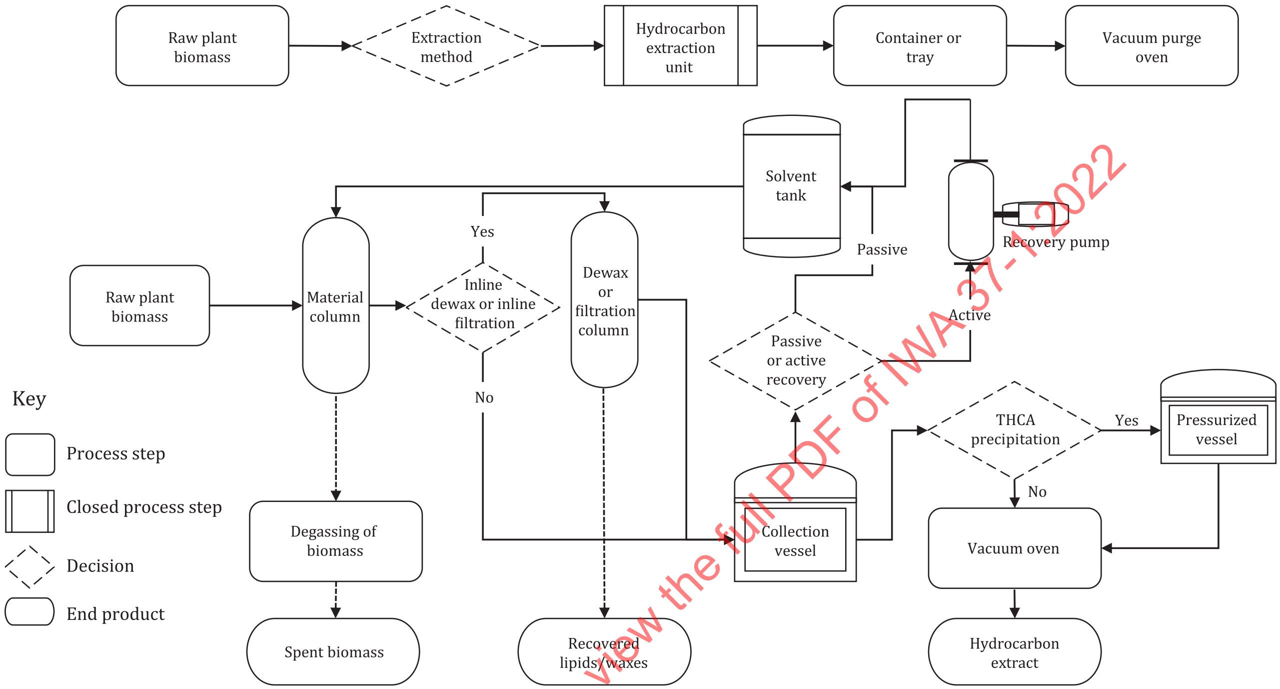

Figure 2 — Hydrocarbon extraction process flow

6.9 Hydrocarbon extraction methods and techniques

6.9.1 In-line adsorbent/absorbent filtration is a chromatography process that allows the capability to remove undesired constituents from the solution using different filtration medias.

6.9.2 THCa crystallization is an inline method of crystallization at the end of the extraction process during solvent recovery.

NOTE 1 This process requires solvent be left in the collection vessel with the cannabinoid extract. The mixture of solvent and cannabinoid extract creates a solution which is then transferred into a crystallization vessel that is suitable for the pressures involved, and solvent corrosivity. The solution is left to promote precipitation of THCa crystals from the solution. Ventilation for off-gassing of solvents is typically required.

NOTE 2 Nitrogen can also be used to slightly pressurize the system to assist in transferring solvent through the extraction process, or to cause the environment within process lines and equipment to become inert.

6.10 Carbon dioxide extraction

6.10.1 Carbon dioxide extraction involves the use of liquid carbon dioxide.

High pressure pumps and heat exchangers are used to regulate solvent density to achieve gas phase or liquid phase properties.

Multiple collection separators use temperature and pressure to create phase change separations with the proper environment to drop out different compounds by weight.

6.10.2 Carbon dioxide extraction equipment adjusts pressures and temperatures to manipulate carbon dioxide into various phases.

The extraction process starts with gaseous or liquid carbon dioxide. The gaseous or liquid carbon dioxide is pressurized by a hydraulic or compressor pump.

After leaving the compressor, the carbon dioxide has reached a pressure above its critical pressure and is in a liquid phase.

The pressurized carbon dioxide solvent passes through a heat exchanger system to achieve the parameters of super-critical extraction of biomass.

6.10.3 Supercritical carbon dioxide is achieved when the extraction chamber parameters reach 7 384 kPa (1 071 psi) and 31,1 °C (87,98 °F). When a molecule is in a supercritical state, it has properties of both liquid and gas. Supercritical carbon dioxide solvent can reach into minute spaces but can also dissolve and act like a liquid solvent.

The physical properties of supercritical carbon dioxide are easily manipulated.

NOTE When extracting using carbon dioxide solvent, it is best practice to source food grade carbon dioxide for product safety and quality.

6.10.4 See Table 1.

6.11 Carbon dioxide extraction process flow

6.11.1 When extraction operating parameters are reached, the carbon dioxide solvent is directed to the biomass column to begin extraction.

The carbon dioxide solvent and extracted constituents flow into a separatory vessel where a change in temperature and pressure create separation of the extracted constituents from the carbon dioxide solvent.

NOTE A phase change back to a gaseous state is the cause of the solvent removal. This gaseous solvent will proceed to a condensing system to be collected.

6.11.2 The bottom of the separator vessel is used as a collection port to remove the extracted constituents that are subsequently transferred into another vessel.

6.11.3 Multiple temperature zones are incorporated into the system to ensure stable temperatures and phase changes are achieved during the process.

Figure 3 illustrates the carbon dioxide extraction process flow.

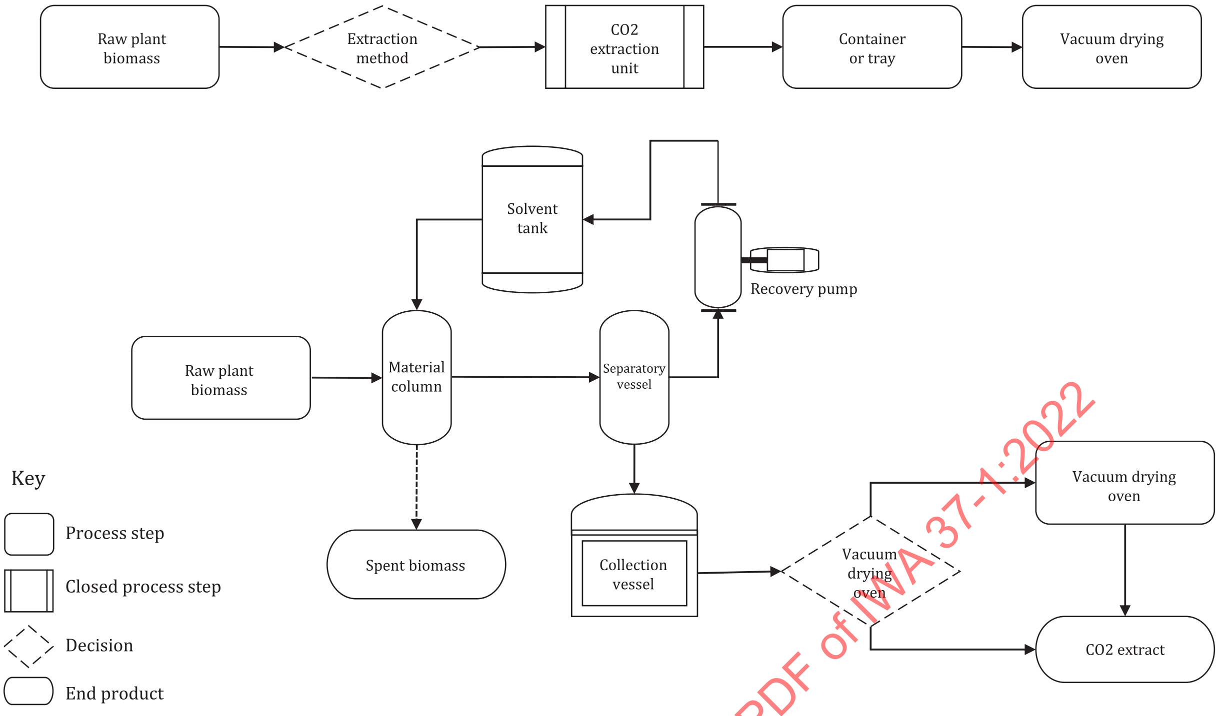

Figure 3 — Carbon dioxide extraction process flow

6.12 Carbon dioxide extraction supporting and ancillary equipment

6.12.1 Some facilities can use bulk carbon dioxide storage vessels externally situated to feed the extraction systems and designed to deliver carbon dioxide at a low to medium pressure.

6.12.2 High pressure pumps can be used to feed the extraction systems with pressures greater than 4 826 kPa (700 psi).

NOTE In some applications, relay or transfer pumps are used.

6.12.3 High pressure carbon dioxide cylinders and dewar vessels are used to charge the extraction systems with carbon dioxide for processing.

6.12.4 Large chillers are needed for some systems to lower the temperature of the condensing system where the process carbon dioxide solvent is re-condensed to liquid state.

6.13 Carbon dioxide co-solvent extraction

6.13.1 Flammable solvents are sometimes used as co-solvents in systems designed for carbon dioxide extraction.

Co-solvents are used to change and enhance the extractive properties of the primary carbon dioxide solvent.

6.13.2 The use of flammable co-solvents during processing and post-processing should be considered early in the facility planning process.

Equipment that uses flammable co-solvents shall be approved for such use.

6.13.3 Flammable co-solvents shall not be introduced in existing carbon dioxide extraction equipment unless designed and installed in accordance with other clauses of this document.

NOTE Some carbon dioxide extraction systems are not designed or constructed for this use and can therefore present significant risk of hazards if flammable co-solvents are introduced.

6.14 Alcohol extraction

6.14.1 Alcohol extraction commonly uses high proof ethanol or isopropyl alcohol.

6.14.2 Alcohol extraction systems that require large quantities of solvent shall be paired with large solvent recovery systems. See 7.3.

6.14.3 See Table 1.

6.15 Alcohol extraction process flow

6.15.1 Batch and semi-continuous extraction methods are used, dependant on the scale of the operation.

6.15.2 Batch extraction uses a pre-selected weight of biomass intended for extraction.

Batch extraction units can be standalone systems with collection vessels or built in-line as a closed-loop system to minimize contamination risks.

During batch extraction, biomass is loaded into a vessel, column, or centrifuge.

For batch extraction that uses a centrifuge, the biomass is generally contained in a micron mesh bag to retain the biomass particulate during extraction.

The solvent is introduced to the biomass by pump, pressure, or vacuum and is usually a stationary soak(wash), self-recirculation, or high-speed centrifugal agitation to create a slurry.

The slurry can pass through multiple filtration apparatus to remove lipids and waxes.

The extracted oil and slurry are subjected to solvent recovery as the next step in the process. See 7.3.

NOTE The slurry can be collected into a holding vessel to be filtered later.

6.15.3 Semi-continuous extraction is best used for commercial production scale operations.,

Semi-continuous extraction typically uses a decanter centrifuge, also known as a solid liquid separator.

Biomass is brought into the system through a constant and metered feeding mechanism and is mixed with a solvent to create a slurry.

The slurry is transferred by a pump to the decanter centrifuge, where they are separated. The biomass and solvent solution are then discharged at different rates from the system.

Figure 4 illustrates the alcohol extraction process flow.

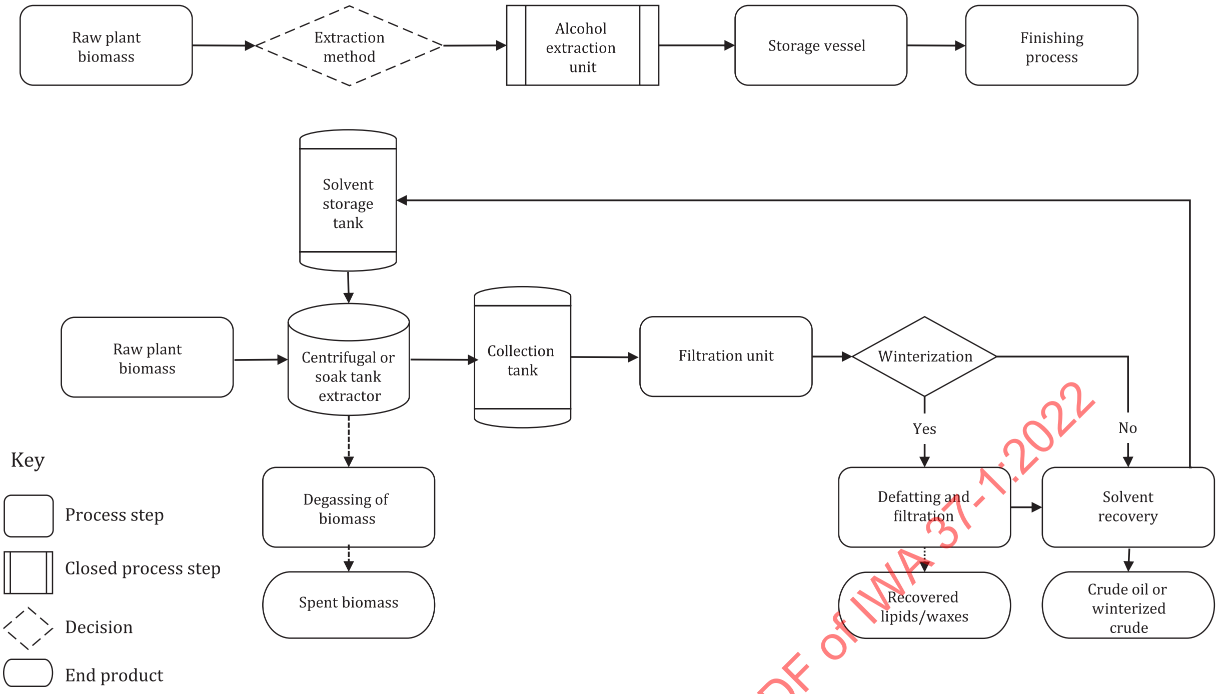

Figure 4 — Alcohol extraction process flow

6.16 Alcohol extraction ancillary equipment

6.16.1 During the alcohol extraction process, either cold temperature or warm temperature alcohol may be used.

NOTE 1 Recirculating heaters and chillers are commonly used in the extraction process. These systems recirculate a heat transfer fluid (HTF) (typically H_2O/glycol mix, silicon oil, etc) to provide a controllable source of heat or cooling to jacketed vessels on the extraction system. Alcohols are not used as a HTF for chillers because this can present increased fire hazards (reference can be made to the manufacturer recommendations for alternative HTF options).

The recirculating HTF provides heat transfer to the application vessel. The common wall that the core vessel and vessel jacket share, is heated and cooled through conduction. The HTF is not exposed to the core of the vessel where solvent is present. This heating function is typically used to evaporate solvents in the collection/reaction vessel (core vessel) of the extractor, thus separating the desired constituents (concentrate) from the solvent.

The chilling function is typically used in two main applications in the extraction process as described below. In one application the goal is to lower the temperature of the solvent itself, the biomass being extracted, and the entire process in general. By lowering the solvent temperature in-process, the modified solution solubility results in the extraction of a lower level of undesired constituents such as lipids, and chlorophyll.

The second application uses recirculating chillers to minimize the heat load generated by recovery systems. After the solvent has been evaporated within the collection vessel, the vapour is then routed to a recovery system. The recovery system creates a constant pull on the vapour stream and compresses the vapour to the point that it begins to change back to a liquid state. This compression and phase change generates energy in the form of heat.

Alternatively, if the warm solvent coming from the discharge of the recovery system is routed through a jacketed heat exchanger to absorb the heat load created by compression of the solvent vapour, then more consistent operating pressures and greater extraction cycle efficiency can be achieved.

NOTE 2 In batch and semi-continuous extraction methods, solvent is stored in a jacketed vessel and large chilling platforms can be used to chill the solvent.

6.16.2 Vacuum pumps are generally used in the recovery process to aid vapour movement through the system.

6.16.3 Vacuum pumps, positive displacement pumps, diaphragm pumps, mag-drive pumps and other solvent safe pumps can be used to transfer slurry or solution through the extraction process for batch and semi-continuous operations.

6.16.4 Nitrogen may also be used to slightly pressurize the system to assist in transferring solution or slurry through the extraction process, or to cause the environment within process lines and equipment to become inert.

6.17 Alcohol extraction solvent recovery

6.17.1 The selection of a solvent recovery system depends on the scale of the operation and the amount of process solvent used in the operation.

NOTE Solvent recovery systems can be either integral to the extraction equipment, a single stand-alone unit, or a set of interconnecting modules to create a closed loop system.

6.17.2 Solvent recovery systems can also include a secondary stage which handles the de-volatizing, de-gassing, and decarboxylation processing steps in-line.

6.18 Filtration required for alcohol extraction

6.18.1 Filtration is used to remove small biomass particulates as well as dirt, sand, clays, lipids, and waxes from the solution. See 6.9.1.

6.18.2 There are multiple types of filtration that are used for alcohol extraction. The primary types of filters are bag-housing filters, lenticular filters, and cartridge housing filters.

6.18.3 Filtration units and systems shall maintain a closed environment during operation for safe practices.

6.19 Alternate extraction methods

For alternate extraction methods not described in the body of this document, see Annex B.

7 Post-processing refinement

7.1 General

7.1.1 Post-processing refinement can be described as any, and all steps after the cannabis extraction process for the removal of unwanted compounds including, but not limited to: lipids, waxes, pigmentation, aromatics, or pesticides.

The cannabinoid extract can be further refined or directly used for food derivatives, vaporizer cartridges, capsules, natural health products, or different consumer packaged goods.

7.1.2 Processes use different types of solvents, ultra-low temperature freezers, filtration apparatuses, heating/cooling apparatuses, reactor tank units and pumping mechanisms to perform the various processes.

NOTE Additional information is given in ANSI/CAN/UL/ULC 1389.

7.1.3 The steps of post-processing are as follows:

a) defatting: winterization and filtration;

b) solvent recovery;

c) liquid-liquid separations: polar contaminant removal;

d) degassing: devolatilization and decarboxylation;

e) distillation;

f) isolation and separation.

7.1.4 Post-processing refinement techniques can use flammable solvents.

All equipment used in the following methods shall be suitable for their intended use and installed within an acceptable area. See Clause 4 and Clause 5.

7.1.5 The information in this clause is intended to identify the methods and potential risks associated with respective post-processing refinement steps.

7.1.6 Where vacuum pumps are used, consideration shall be given to ventilation of the intake and exhaust lines and piping.

Figure 5 illustrates the post-processing refinement.

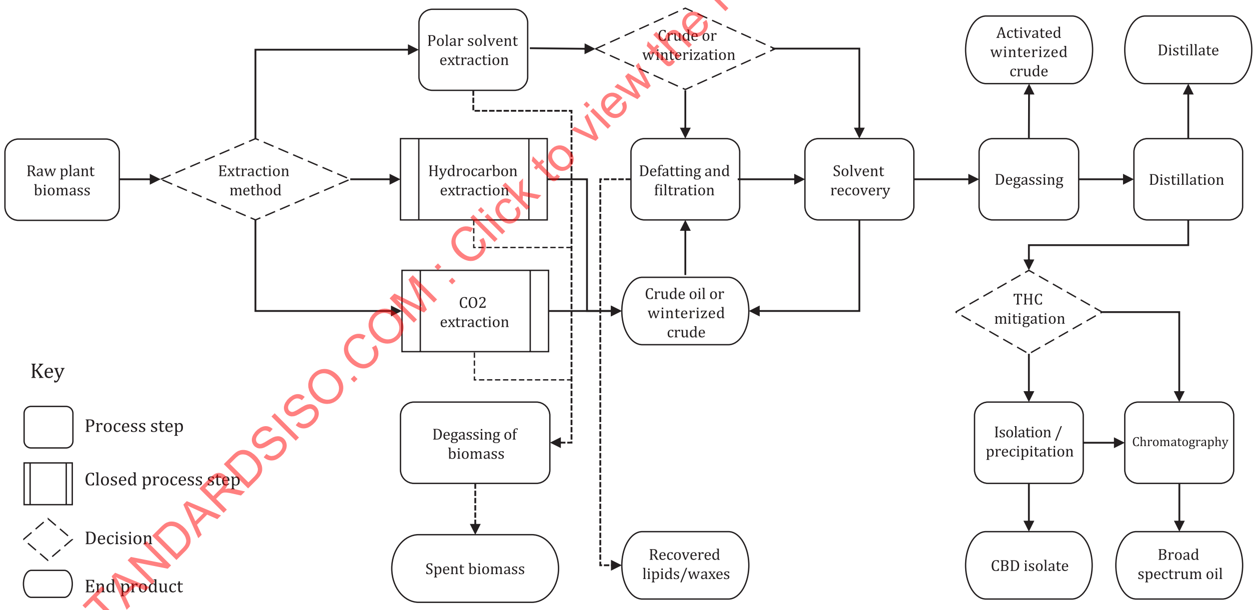

Figure 5 — Post-processing refinement

7.2 Defatting: Winterization and filtration

7.2.1 General

7.2.1.1 During the extraction of active oils from biomass, other compounds can be extracted in addition to cannabinoids.

Depending on the extraction method and solvent used, various amounts of these compounds are extracted.

7.2.1.2 The first step in refinement is typically to remove the waxes, lipids, and unwanted compounds from the extract.

This is completed by dissolving the extract into an alcohol or polar solvent (methyl alcohol, ethyl alcohol, isopropyl alcohol, acetone) to physically separate the insoluble waxes/lipids from the extract.

The ratio in which extract is mixed with solvent varies based on extraction method and wax/lipid content within the extract.

7.2.1.3 See Table 2 for information on post-processing risks and hazards.

Table 2 — Risks and hazards: Post-processing

Risk	**Hazard**	**Process**						
		Defatting		**Solvent recovery**	**Liquid-liquid**	**Degassing**	**Distillation**	**Isolation and separation**
		Winterization	**Filtration**		**Polar contaminant removal**	**Devolatilization and decarboxylation**		
Waste disposal: Fats and lipids	Compatibility: Fats/lipids	✓	✓	×	×	×	×	×
	Waste receptacles	✓	✓	×	×	×	×	×
	Water soluble pesticides	✓	✓	×	✓	×	×	×
	Compatibility: receptacles	✓	✓	×	✓	×	×	×
Pumps: Liquid transfer/filter/oil	Solvent: Seals/gaskets	✓	✓	✓	✓	✓	✓	×
	Solvent: Motor compatibility	✓	✓	✓	✓	✓	✓	×
	Oil mist	✓	✓	✓	×	×	✓	×
	Vacuum Implosion	×	×	✓	×	×	✓	×
Solvent	Open pouring	✓	✓	✓	×	×	×	×
	Use and storage	×	×	✓	✓	✓	×	✓
	Solvents in vessels	×	×	✓	✓	×	×	✓
	Toxicity	×	×	✓	×	×	×	×
	Agitation	×	×	×	✓	✓	×	✓
	MAQ	×	×	✓	✓	✓	×	✓

Table 2 *(continued)*

Risk	Hazard	Process						
		Defatting		Solvent recovery	Liquid-liquid	Degassing	Distillation	Isolation and separation
		Winterization	Filtration		Polar contaminant removal	Devolatilization and decarboxylation		
Heating and evaporation	Electronic elements	✗	✗	✓	✗	✓	✗	✗
	Solvent compatibility	✗	✗	✓	✗	✓	✗	✗
	Heating recirculators	✗	✗	✓	✗	✓	✗	✗
	Steam generators	✗	✗	✓	✗	✓	✗	✗
	Forced air ovens	✗	✗	✗	✗	✓	✗	✗
	Vacuum ovens	✗	✗	✗	✗	✓	✗	✗
Vessels (mixing)	Pressure	✗	✗	✗	✓	✓	✗	✓
	Agitation (Explosion/ air-driven)	✗	✗	✗	✓	✓	✗	✓
	Temperatures	✗	✗	✗	✓	✓	✗	✓
	Compatibility: Steel, glass, plastic	✗	✗	✗	✓	✓	✗	✓
	Solvent recovery: Organic phase	✗	✗	✗	✓	✗	✗	✗
Open baths: Heat transfer	Allergens, i.e. Nut oil	✗	✗	✗	✗	✓	✗	✗
	Smoke, flash/ boiling points	✗	✗	✗	✗	✓	✗	✗
Distillation apparatuses	Temperature regulation device	✗	✗	✗	✗	✗	✓	✗
	Electronic heating element	✗	✗	✗	✗	✗	✓	✗
	Heat re-circulator	✗	✗	✗	✗	✗	✓	✗
	Steam generator	✗	✗	✗	✗	✗	✓	✗
	Compatibility: Steel, glass, plastic	✗	✗	✗	✗	✗	✓	✗

Table 2 *(continued)*

Risk	Hazard	Process						
		Defatting		Solvent recovery	Liquid-liquid	Degassing	Distillation	Isolation and separation
		Winterization	Filtration		Polar contaminant removal	Devolatilization and decarboxylation		
Cold traps	Solvent hazards	×	×	×	×	×	✓	×
	Waste disposal	×	×	×	×	×	✓	×
	Volatile fraction condensates	×	×	×	×	×	✓	×
	Liquid nitrogen	×	×	×	×	×	✓	×
Environment and personnel safety	Sharp objects	✓	✓	✓	✓	✓	✓	✓
	Wet floors	✓	✓	✓	✓	✓	✓	✓
	Trips/falls	✓	✓	✓	✓	✓	✓	✓
	Heavy objects	✓	✓	✓	✓	✓	✓	✓
	Temperature rated equipment	✓	✓	✓	✓	✓	✓	✓
	Temperature rated glass	✓	✓	✓	✓	✓	✓	✓
	Labelling of hot/cold surfaces	✓	✓	✓	✓	✓	✓	✓
	Heat ventilation	✓	✓	✓	✓	✓	✓	✓

7.2.2 Process

7.2.2.1 Where carbon dioxide and hydrocarbon extraction methods are used, a solution is then created by mixing the crude oil with a solvent, usually a polar solvent, prior to the winterization step.

With alcohol extraction, since the alcohol is already saturated with crude oil, the process leads directly to the winterization step.

7.2.2.2 The alcohol/oil solution is typically chilled to ultra-low temperatures in a freezer unit capable of maintaining temperatures ranging from 0 °C to -80 °C. The equipment shall be suitable for use with flammable solvents.

7.2.2.3 Vessels and containers shall be suitable for the temperatures identified in 7.2.2.2 and the type of solvents involved.

NOTE 1 Elastomers and seals within containers can become hard or brittle at lower temperatures.

NOTE 2 An alternate power source, such as a generator, can be considered for cold storage equipment to reduce the likelihood of increased temperatures and pressures within sealed storage vessels in case of a primary power failure.

7.2.2.4 Lipids, waxes, and other inactive compounds precipitate out of the mixture and become semi-solid during the winterization process.

NOTE Lower temperatures, will increase the speed of winterization.

7.2.2 Filtration

7.2.3.1 The removal of precipitated lipids, waxes, and other inactive compounds is achieved using filtration techniques after the winterization process is complete.

7.2.3.2 For lab scale processing applications, a porcelain, stainless steel, or silicone filtration system is typically used with cascading micron filter paper sizes (commonly known as a Buchner funnel),

This requires an open transfer of the saturated solution into the filtration apparatus. Since the solvent is cold the concentration of flammable vapours generated during off-gassing is reduced.

NOTE Proper ventilation is important, as the process is done in an open environment. A suitable overhead hood is an example of a ventilation component that can be used to minimize hazardous concentrations of flammable vapours. See 4.2.3 and 4.8.

7.2.3.3 All vacuum pumps used for this process shall be compatible for solvent use, i.e. a dry diaphragm pump with polytetrafluoroethylene (PTFE) heads.

7.2.3.4 For large processing applications, industrial filter presses, lenticular, or bag-style filter vessels may be used.

These systems often use positive displacement pumps instead of vacuum or gravity to move the solution.

Due to the volume of solvents involved, the degree of hazard is greater in large scale than in lab scale applications. The use of solvents shall be considered in conjunction with Clause 4.

7.3 Solvent recovery

7.3.1 General

7.3.1.1 After the crude oil has been filtered and winterized, the oil shall be separated from the solvent using a solvent recovery system.

7.3.1.2 The two most common types of solvent recovery systems are rotary evaporators and rising/falling-film systems.

Solvent recovery systems allow the recovery of the solvent (most often alcohols) that were used during the winterization or extraction step.

This recovered solvent can then be re-used for various processing needs.

The solvent can be reproofed by distillation or with the use of drying agents.

These processes shall be conducted in an area with proper ventilation in accordance with Clause 4.

7.3.2 Process

7.3.2.1 Rotary evaporators are typically used as the main form of solvent recovery for lab scale processing applications and are available in a variety of sizes that are specifically designed for the purpose. Components of rotary evaporator systems made of glass such as flasks, condensers, and tubing should conform to ISO 3585.

7.3.2.2 During this process, the solution is fed into the boiling (evaporating) flask at a reduced pressure using a vacuum pump.

7.3.2.3 The boiling/evaporating flask is then rotated via a motor chuck while partially submerged in a temperature controlled heated water or oil bath.

7.3.2.4 Using vacuum pressures and heat, the solvent is evaporated from the solution

The vapour travels towards the source of vacuum, which is preceded by a condenser.

The condenser is cooled using suitable fluids in a liquid re-circulator.

The solvent vapour is condensed, and gravity drains into a collection vessel located below the condenser.

7.3.2.5 For large processing applications indoors, falling, or rising film evaporators can recover significant amounts of solvent.

7.3.2.6 These continuous systems operate using liquid transfer pumps or pressure differential to feed a heated evaporation device or unit with significant surface area.

The evaporation device is typically heated using a heated liquid re-circulator, hot water, or steam.

7.3.2.7 The evaporated solvent vapour is condensed on a similar condensing apparatus (shell and tube with significant surface area) which is chilled using tap water, chilling apparatus, or facility infrastructure.

Chilling apparatus should be placed outside of the control area.

7.4 Liquid-liquid separations: Polar contaminant removal

7.4.1 General

7.4.1.1 Liquid-liquid separation is a form of liquid partition chromatography which uses at least two immiscible liquids to separate compounds based on their solubility within the respective liquids.

The liquids employed are usually a polar/aqueous liquid (i.e. water) and a non-polar organic solvent (I.e. hexane or heptane).

7.4.1.2 In this process the crude oil is dissolved into the non-polar organic solvent at a pre-determined ratio and is combined with a brine solution and mixed in order to extract the polar contaminants that can be present in the crude oil.

NOTE Depending on the extraction method used, and the temperature and pressure of the extraction process, measurable amounts of sugars, gums, phospholipids, and chlorophyll can be extracted from the biomass due to the polarity and efficiency of the solvent.

7.4.2 Process

7.4.2.1 The crude oil is first dissolved into a non-polar solvent such as pentane, hexane or heptane.

Ideally, heptane is used due to its low-toxicity classification (Class 3) as well as its high boiling point-making it the ideal choice for this process.

A brine solution is then created using water and salt.

The water is heated to a value equal or less than 100 °C to allow for efficient salt addition. The brine solution is mixed with the crude solution at specific ratios based on standard operating procedures.

7.4.2.2 For lab scale operations, this process is most often completed in a separatory funnel apparatus within a fume hood.

The brine solution (aqueous) and the oil solution (organic) are loaded into the separatory funnel, with expansion/head space allowance.

The top of the funnel is closed and inverted to agitate the solution by "shaking up" the solution.

Depending on the temperature of the brine solution, pressure can build up inside of the funnel.

7.4.2.3 When the appropriate number of agitation cycles is complete, the solution is permitted to settle, and an emulsion layer will form between the aqueous and organic layers.

This emulsion layer is typically where insoluble contaminants and undesirable compounds will materialize.

Other polar contaminants will be "extracted" from the oil solution into the brine solution.

NOTE This process can be completed several times using variable PH washes to remove contaminants from the oil solution.

When the desired number of washes have been completed, the final solution is drained into an appropriate storage vessel or container.

7.4.2.4 For commercial production scale operations, liquid-liquid separation is often completed in a jacketed reactor made of glass or stainless steel.

The preparation process is identical to that of lab scale operations except for loading into a larger, stationary vessel.

This operation will use an agitator/mixer that is mounted to the reaction vessel.

7.4.2.5 Means shall be provided to mitigate the possibility of pressure build up.

NOTE Additional information is given in ANSI/CAN/UL/ULC 1389.

7.4.2.6 After the brine solution has been refined the next step in the process is solvent recovery. See 7.3 for additional information regarding solvent recovery.

7.5 Degassing: Devolatilization and decarboxylation

7.5.1 General

7.5.1.1 Degassing of extracts is comprised of two main processes: devolatilization and decarboxylation.

These two processes occur after solvent recovery to remove residual solvents as well as achieve the most desirable results in distillation.

Devolatilization and decarboxylation can be achieved in one step.

7.5.1.2 The crude oil can contain residual solvent after the solvent recovery process.

This solvent shall be removed prior to the distillation step. Having low levels of solvent improves efficiencies and reduces risks associated with the distillation process.

7.5.2 Process

7.5.2.1 For lab scale operations there are several methods that may be used.

One method is to perform this process within atmospheric conditions in a glass or stainless-steel beaker on a hotplate stirrer.

The hotplate stirrer should have a temperature limit of at least 200 °C and be placed within a fume hood for appropriate ventilation.

Magnetic stirring from within the hotplate (with a PTFE stir bar) or overhead stirring may also be used.

7.5.2.2 When performing decarboxylation, excess capacity should be maintained within the container to prevent boil-over and spillage during the process.

7.5.2.3 Other methods that are used for this process include but are not limited to; rotary evaporators, forced air (convection) ovens, vacuum ovens, induction heaters with overhead stirrers, or jacketed reaction vessels.

7.5.2.4 If rotary evaporators are used for this process, a heating oil or heat transfer fluid with higher boiling point than that of water (which is typically used as the bath contents) shall be used in order to reach 100 °C to 140 °C.

NOTE Use of nut oils, including peanut oil, is avoided as allergens can be present.

Other types of heat transfer fluids/oils may be used to achieve elevated bath temperatures due to their inherent high smoke/flash points.

7.5.2.5 For commercial production scale operations, top stirred reactor systems are used for processing (i.e. jacketed glass or stainless).

During the devolatilization and decarboxylation step, the remaining solvent, water, other low boiling point compounds (terpenes), and carbon dioxide are removed from the material and collected through a condensing system, which may be cooled using a liquid re-circulator.

NOTE Light vacuum is used in both lab scale and commercial production processes to assist in the removal of volatile compounds as well as providing a closed environment.

7.5.2.6 Means shall be provided to mitigate the possibility of pressure build up in accordance with 7.4.2.5.

7.6 Distillation

7.6.1 General

Distillate is a refined resin which contains a high percentage of the target cannabinoids.

To perform distillation, there are typically two types of systems that are used:

a) benchtop short path systems (lab scale), or

b) wiped/thin film systems (commercial production scale).

NOTE If the degassing step is completed correctly, minimal amounts of residual solvent will be present. See 6.8.5, Note 1.

7.6.2 Process

7.6.2.1 During the distillation process, the apparatus is brought under vacuum to lower the boiling point of the solution which limits degradation of the targeted compounds.

Maximum operating system temperatures typically range from 190 °C to 230 °C, depending on the target compounds as well as the contents of the starting material.

7.6.2.2 Benchtop short-path distillation systems operate by increasing temperature of the input material (winterized oil) to and through the boiling point of targeted cannabinoids.

7.6.2.3 When targeted boiling temperatures are achieved, vapours will travel from the boiling flask, through the distillation head, to the condenser.

The condenser is often chilled or heated via a re-circulating chilling/heating unit.

NOTE Glassware does not necessarily appear hot even when over 200 °C; therefore, it is important to use proper labelling and PPE to avoid burns, and to protect against potential glassware breakages.

7.6.2.4 Wiped/thin film distillation systems operate on a continuous or batch principle, by using fixed heating and cooling systems to separate compounds based on their boiling point.

Material is dispensed into the evaporator body using feed pumps or gravity.

A motorized wiper basket creates a thin film of material around the outside of the body, which is heated to a specific temperature.

7.6.2.5 Once the distillation process is complete, the distillate will then drain by gravity or pumping mechanism into collection containers.

Compounds that are too heavy to evaporate based on set temperature will travel down the evaporator wall and drain into a residue collector.

7.6.2.6 There are various pumps used for these applications such as: gear pumps, peristaltic pumps, lobe pumps, etc.

Heating may be provided by electric heating elements (band heaters) or re-circulating heaters for jackets. Heating/chilling for condensers may be provided by re-circulating heaters/chillers.

Systems will often include manifolds or plumbing for heat or chilling lines; these shall be appropriately labelled and insulated where applicable to ensure operator safety.

7.6.3 Cold traps

Cold traps are used to protect vacuum pumps from solvents and other contaminants.

Flammable solvents are often used to provide additional chilled surface area to the trap. In between usages, the solvent will be gradually brought back to ambient temperature.,

NOTE 1 Small quantity condensates collected in the cold traps can contain residual solvents,

NOTE 2 Liquid nitrogen is also used in some instances for cold traps. It is important to use proper PPE and pressure relief valves to avoid cold burns and pressure build up within enclosed traps.

7.7 Isolation and separation

7.7.1 General

Isolation and separation may use various separation techniques such as column chromatography, flash/preparative chromatography, super-saturation, and or centrifugal partition chromatography (CPC) to achieve pure isolated cannabinoids.

NOTE These methods use a stationary phase, such as a silica-based media, and a liquids phase, comprised of various solvents (non-polar/polar depending on method/media).

7.7.2 Process

7.7.2.1 The process involves isolation by precipitation,

7.7.2.2 For lab scale operations, distillates and other forms of cannabinoid extracts are dissolved into the proper solvent for isolation by precipitation.

This process is typically done by hand or on a heated magnetic stir plate under a fume hood. The mixture is then cooled to room temperature to reduce the rate of solvent off-gassing.

7.7.2.3 Once precipitation has occurred, the non-crystallized liquid is poured off and stored.

The crystallized substance is then harvested, washed with cold solvent, and dried within a vacuum oven.

The harvesting and washing of the crystallized substance shall take place within a vented fume hood.

7.7.2.4 For commercial production scale operations, distillates and other forms of cannabinoid extracts are dissolved into a solvent suitable for this process.

This process is typically done in a large glass or stainless-steel reaction vessel which uses an overhead stirrer to agitate the solution.

7.7.2.5 This vessel is then heated and chilled using a re-circulator to promote the crystallization process.

7.7.2.6 Various methods of agitation are used to reduce large structure build-up as well as to break up large crystalline structures during the isolation process.

Non-crystallized solution is drained into appropriate storage locations.

Remaining solid crystalline product is washed with chilled, clean solvent to further remove contaminants, and then dried in a vacuum oven.

8 Competence of personnel

8.1 Equipment shall be operated in accordance with applicable standard operating procedures or operating manuals.

NOTE Standard operating procedures and equipment manuals, including requirements for emergency procedures are typically supplied by the manufacturer. If this information is not available from the equipment manufacturer, the equipment owner can consider the minimum requirements in this clause. These requirements are not considered to be inclusive. IWA 37-3 specifies good production practices.

8.2 The installation, operation, and maintenance of equipment, within a cannabis facility shall be conducted by competent persons.

NOTE Additional information is given in ANSI/CAN/UL/ULC 1389.

8.3 Personnel shall be trained on emergency shutdown procedures of the equipment.

8.4 Supervisory staff responsible for the cannabis facility should be on site during the operation.

8.5 Personnel who operate equipment or handle solvents shall be trained in the appropriate procedures for use, storage, and handling of those solvents, as applicable. All training shall be documented.

8.6 Competency of personnel shall be verified, documented, and periodically reviewed.

8.7 Persons responsible for the development of personnel safety training programs shall include a methodology to verify knowledge and competency. These programs include but are not limited to:

a) shadowing and mentoring;

b) testing and certification of individuals;

c) knowledge of PPE;

d) review of equipment operating manuals;

e) emergency planning procedures (see 4.7);

f) review of local codes and regulations where applicable;

g) documentation and record keeping.

NOTE 1 When mixing different chemicals or solvents, it is important to wear the appropriate PPE. Occupational health and safety regulations can apply.

NOTE 2 It is important to wear fire-resistant clothing when working with flammable solvents. Additional information on preventing charge accumulation on personnel is given in NFPA 77.

NOTE 3 Additional information regarding the development of a safety training program is given in ISO 45001.

9 Preventive maintenance

A preventive maintenance program shall be developed in conjunction with the equipment manufacturer, and should include, but not be limited to, the following items:

a) inspection schedules;

b) manufacturers recommended frequency for preventative maintenance of equipment;

c) procedures on how to safely maintain the equipment;

d) calibration of equipment shall be performed as per the manufacturer’s recommendations;

e) equipment cleaning procedures and validations based on GPP.

Annex A
(informative)

Information on hazardous areas

A.1 General

This following information is intended to provide guidance for cannabis buildings, equipment, and oil extraction operations where explosive atmospheres can be present.

This information is in references to; combustible liquid, flammable gas, flammable liquid, and combustible dust to identify the types of hazardous materials discussed in this document.

The terms explosive atmospheres, explosive dust atmospheres, explosive gas atmospheres are used to identify potentially hazardous areas where hazardous materials can be present.

The process of identifying hazardous areas can be different in various countries or jurisdictions.

There can be minor differences in how the same hazardous materials are identified in Building Codes, Fire Codes, Electrical Codes, etc.

The following information is intended to provide the user of this document guidance on this topic.

A.2 Area classification

A.2.1 General

Area classification is a process to assess an area where hazardous materials can be present in sufficient quantities for an explosion to occur.

This involves identifying the materials and the amount of material present and the frequency and duration of any release into the atmosphere.

It also identifies areas where hazardous materials are not normally present, but where an unintentional release can occur in case of malfunction, breakdown, or other unexpected failure.

Area classification identifies the hazardous materials based on their physical and explosive properties.

Cannabis processing operations use various flammable or combustible chemicals in the oil extraction process and plant processing operations can generate combustible dusts.

Area classification addresses the potential of forming both explosive gas atmospheres and explosive dust atmospheres. Since gasses and dusts move differently in air, area classification requires a three-dimensional assessment of each location.

Area classification shall be carried out by those who understand the relevance and significance of properties of flammable materials and those who are familiar with the process and the equipment along with safety, electrical, mechanical, and other qualified engineering personnel.

EXAMPLE From a physical perspective, vapours from the chemicals used can be lighter, heavier, or the same density as air. This influences how a location is identified and the precautions needed.

Internationally, two different systems are used to conduct and area classification:

- Zone system: based on the IEC 60079 series and used in most jurisdictions;

- Class/division system: used primarily in North America and based on NFPA 70 (in the US) and CSA C22.1 (in Canada) and used occasionally in other countries.

NOTE 1 The US and Canada permit the use of both the class/division and zone systems in their regulations. Facilities are permitted to use both systems in one area however the area classifications systems cannot overlap. Both class/division and zone approved electrical equipment can be used in either system following the rules in the applicable electrical codes.

NOTE 2 In the US, NFPA 70 allows the option to select either the class/division or zone system.

NOTE 3 In Canada, CSA C22.1 only permits the use of the class/division system in existing facilities (those built prior to the adoption of the zone system). Use of the zone system is mandatory for all new construction.

A.2.2 Definitions of hazardous areas

A.2.2.1 Zone system

A.2.2.1.1 Explosive atmosphere

Mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour, dust, fibres or flyings which, after ignition, permits self-sustaining propagation.

A.2.2.1.2 Explosive gas atmosphere

A mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour, or mist in which, after ignition, combustion spreads throughout the unconsumed mixture.

These are separated into three zones based on the level of hazard.

- Zone 0: Locations in which explosive gas atmospheres are present continuously or are present for long periods.
- Zone 1: Locations in which explosive gas atmospheres are likely to occur in normal operation; or the location is adjacent to a Zone 0 location, from which explosive gas atmospheres can be communicated.

  NOTE 1 Zone 1 locations includes areas adjacent to a Zone 0 location where materials can occasionally be communicated unless such communication is prevented by an impervious barrier or adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

- Zone 2: Locations in which explosive gas atmospheres are not likely to occur in normal operation and, if they do occur, they will exist for a short time only; or the location is adjacent to a Zone 1 location, from which explosive gas atmospheres can be communicated.

  NOTE 2 Zone 2 locations includes areas adjacent to a Zone 1 location where materials can occasionally be communicated unless such communication is prevented by an impervious barrier or adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

A.2.2.1.3 Explosive dust atmospheres

A mixture with air, under atmospheric conditions, of flammable substances in the form of dust, fibres, or flyings which, after ignition, permits self-sustaining propagation

These are separated into three zones based on the level of hazard.

- Zone 20: A place in which an explosive dust atmosphere, in the form of a cloud of dust in air, is present continuously, or for long periods or frequently.
- Zone 21: A place in which an explosive dust atmosphere, in the form of a cloud of dust in air, is likely to occur in normal operation occasionally.

NOTE 1 Zone 21 locations includes areas adjacent to a Zone 20 location where materials can occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

- Zone 22: An area in which an explosive dust atmosphere, in the form of a cloud of combustible dust in air, is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

NOTE 2 Zone 22 locations includes areas adjacent to a Zone 21 location where materials can occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

NOTE 3 It is also important to consider the potential of creating an explosive dust cloud from a dust layer in Zones 20, 21 and 22.

A.2.2.2 Class/division system

Materials are identified by three classes and each class is separated into two divisions based on the level of hazard.

- Class I, Division 1 (explosive gas atmospheres): Areas in which flammable gases, flammable liquid–produced vapours, or combustible liquid–produced vapours are or can be present in the air in quantities sufficient to produce explosive or ignitable mixtures.
- Class I, Division 2 (explosive gas atmospheres): Areas in which flammable gases, flammable liquid–produced vapours, or combustible liquid–produced vapours are handled, processed, or used, but in which the liquids, vapours, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems or in case of abnormal operation of equipment.

NOTE 1 Class I, Division 2 includes areas adjacent to a Class I, Division 1 location where materials can occasionally be communicated unless such communication is prevented by an impervious barrier, or adequate positive-pressure ventilation from a source of clean air with effective safeguards addressing any ventilation failure.

- Class II, Division 1 (explosive gas atmospheres): Areas in which combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures.
- Class II, Division 2 (explosive gas atmospheres): Combustible dust due to abnormal operations can be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

NOTE 2 Class II, Division 2 includes areas in which combustible dust accumulations are present but are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus, but can as a result of infrequent malfunctioning of handling or processing equipment become suspended in the air or where combustible dust accumulations on, in, or in the vicinity of the electrical equipment can be sufficient to interfere with the safe dissipation of heat from electrical equipment, or can be ignitable by abnormal operation or failure of electrical equipment

- Class III, Divisions 1 and 2 (easily ignited fibres and flyings): Includes areas where easily ignitable fibres or where materials producing combustible flyings are handled, manufactured, or used, but in which such fibres/flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures.

NOTE 3 Class III materials are not normally encountered in cannabis buildings, equipment, and oil extraction operations. The primary risk in Class III locations is the potential of a flash fire, while technically not an explosion, the risk to persons and property are extremely high. Since Class III materials do not typically form a dust cloud, the rules are different than those for Class II.

A.2.2.3 Comparison of class/division and zone systems

Table A.1 provides a comparison of class/division and zone area classification.