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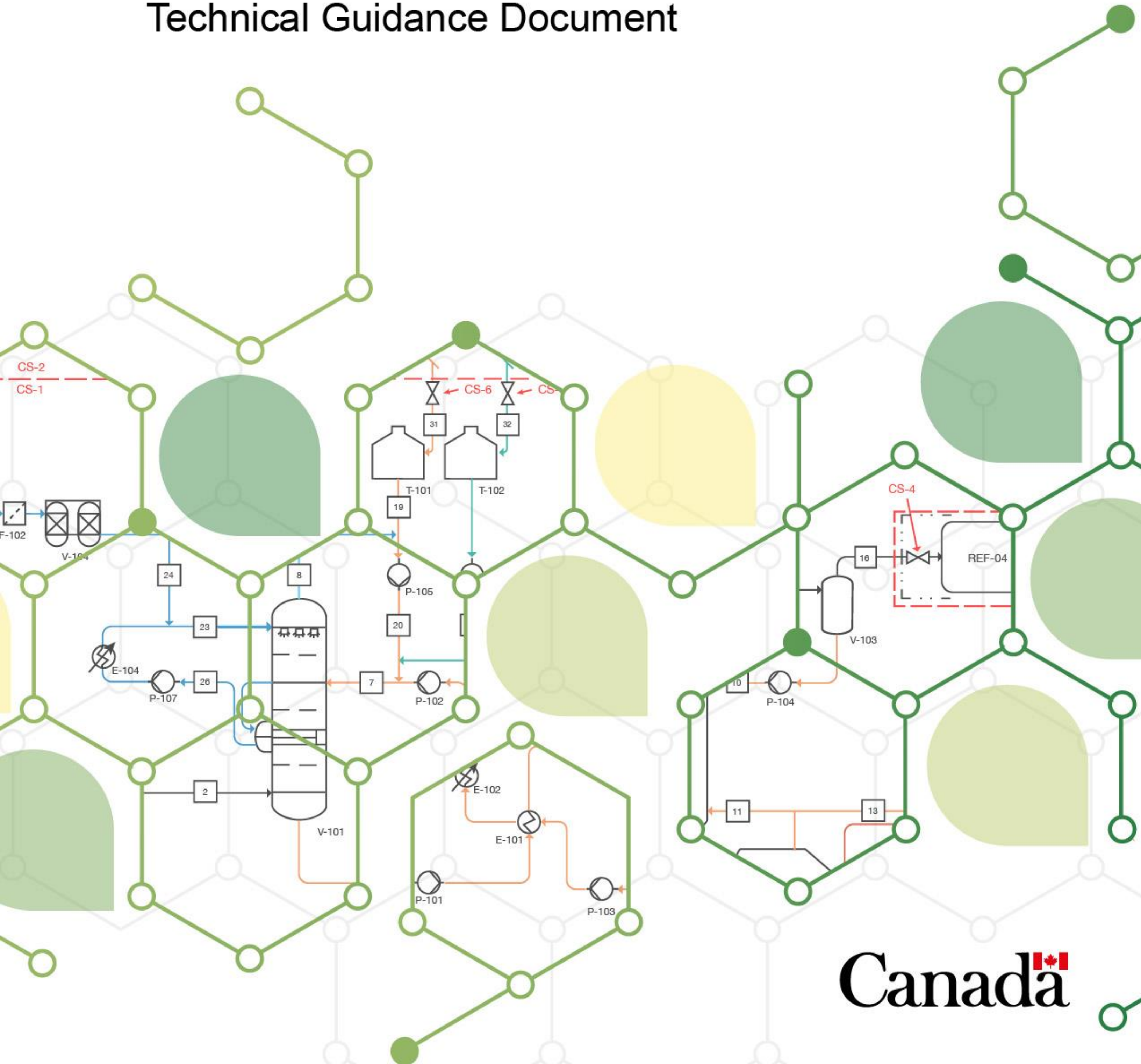
Carbon Capture, Utilization and Storage Investment Tax Credit (CCUS ITC)

Technical Guidance Document



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Disclaimer

This Guide applies conclusively with respect to engineering and scientific matters only. In this Guide, only the information contained in Section 2 through Section 8 refers to engineering and scientific matters. Any information in this Guide that relates to the provisions of the Income Tax Act (the "Act") and Income Tax Regulations (the "Regulations") in respect of the investment tax credit is provided for information purposes only. Since the Canada Revenue Agency is responsible for the interpretation and administration of the Act and the Regulations, for further information concerning the income tax matters described in this Guide contact the Canada Revenue Agency as described in Section 1.3.3.

Aussi disponible en français sous le titre : Document technique sur le crédit d'impôt à l'investissement pour le captage, l'utilisation et le stockage du carbone (*CUSC-CII) Document Technique*

Cat. No. M4-244/2025E-PDF (Online)
ISBN 978-0-660-97565-8

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Abbreviations

Ar	Argon
ASU	Air Separation Unit
ATR	Autothermal Reforming
BECCS	Bioenergy Carbon Capture and Storage
$CaCO_3$	Calcium Carbonate
CaO	Calcium Oxide / Quicklime
CCUS	Carbon Capture Utilization and Storage
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COF	Covalent Organic Framework
CRA	Canada Revenue Agency
DAC	Direct Air Capture
DCC	Direct Contact Cooler
DRM	Dry Reforming of Methane
EOR	Enhanced Oil Recovery
GJ	Gigajoule
H_2	Hydrogen
H_2S	Hydrogen Sulfide
HEX	Heat Exchanger
ITC	Investment Tax Credit
KOH	Potassium Hydroxide
MOF	Metal Organic Framework
MMV	Monitoring, Measurement, and Verification
MWh	Megawatt-hours
N_2	Nitrogen
NaOH	Sodium Hydroxide
NGL	Natural Gas Liquid
NO_x	Nitrous Oxide
NRCan	Natural Resources Canada
O_2	Oxygen
PM	Particulate Matter
POP	Porous Organic Polymer
PSA	Pressure Swing Adsorption
SCM	Supplementary Cementitious Material
SCR	Selective Catalytic Reactor
SMR	Steam Methane Reforming
SO_x	Sulfur Oxide
TRM	Tri-Reforming of Methane
TSA	Temperature Swing Adsorption
UPS	Uninterruptible Power Supply
VAR	Volt-Ampere Reactive
VSA	Vacuum Swing Adsorption

1 Overview

1.1 About This Guide

This edition of the Guide:

- provides information concerning the Carbon Capture, Utilization, and Storage Investment Tax Credit ("***CCUS tax credit***") that is set out in the Act and the Regulations;
- provides guidance on the types of property that are described in Classes 57 and 58 and under ***dual-use equipment*** as defined in the Act;
- applies conclusively with respect to engineering and scientific matters only; and
- provides schematic diagrams of the common ***CCUS process*** types and what equipment and property may be eligible for the CCUS tax credit.

CCUS processes include a broad range of technologies such as pre-combustion, post-combustion, and oxy-fuel combustion processes. While not all of these technologies have been commercialized, they are included for reference.

This Guide may not reflect amendments to the Act and the Regulations but will be updated periodically as the need arises. Taxpayers should consult the latest versions of the Act and the Regulations whenever they are considering a project to ensure that decisions are based on the legislation in force at the time.

1.2 Terms Used in This Guide

Certain terms used in this Guide, including the terms that are defined in subsection 127.44(1) and 211.92(1) of the Act, are summarized in the Glossary of Terms, found in Section 10 of this Guide. Throughout this Guide, terms that are defined in the Act are italicized in bold the first time they appear and excerpts from the Act are shown in italics. The terms "Class 57" and "Class 58" are used to refer to capital cost allowance Class 57 and Class 58 of Schedule II to the Regulations, respectively.

1.3 Services Provided by Finance Canada, Natural Resources Canada and the Canada Revenue Agency

1.3.1 Finance Canada

The legislated conditions of eligibility for the CCUS tax credit are set out in the provisions of the Act and the Regulations. Finance Canada is responsible for developing tax policy, providing advice to the

Minister of Finance, and for the drafting and development of tax legislation and regulations. Comments and concerns regarding the policy considerations related to the legislation may be directed to the following address:

Director General, Business Income Tax Division
Finance Canada
90 Elgin Street, 12th Floor,
Ottawa, Ontario K1A 0G5

E-mail: ccus-cusc@fin.gc.ca

1.3.2 Natural Resources Canada

The CCUS ITC group at Natural Resources Canada (NRCan) is staffed with knowledgeable engineering professionals who are responsible for providing project evaluations of ***CCUS projects*** and verifying that property is described in Class 57, Class 58, or the definition of dual-use equipment. The CCUS tax credit group also advises the Canada Revenue Agency on engineering and scientific matters relating to investments in CCUS projects. If in need of guidance on the NRCan submission process, taxpayers or their authorized representatives are encouraged to contact the CCUS tax credit group at the following address:

CCUS ITC Group
Natural Resources Canada
580 Booth Street, 14th Floor
Ottawa, Ontario K1A 0E4

E-mail: itc_ccus-cii_cusc@nrcan-rncan.gc.ca

To request an initial project evaluation, a taxpayer must complete the pre-screening questionnaire and project plan submission form available on the CCUS ITC webpage. NRCan will require the submission of annual progress reports to verify that property is described in Class 57, Class 58, or the definition of dual-use equipment.

1.3.3 Canada Revenue Agency

For further information regarding the CCUS tax credit as it relates to the CRA and administration, please refer to the CCUS ITC webpage.

1.4 Background

The legislation enacting the CCUS tax credit, as set out in the Act and the Regulations, is the authority in determining the eligibility of expenditures for the CCUS tax credit. Only capital costs of property that is described in Classes 57 and 58 of the Regulations (which are referred to as “Class 57 Property” and “Class 58 Property,” respectively) or described in the definition of dual-use equipment in the Act (which are referred to as “Dual-use Property”), may be eligible for the CCUS tax credit (see sections 1.5 and 1.6, respectively). Among other things, in order to be considered Class 57 Property, Class 58 Property, or Dual-use Property, the property must be part of a CCUS project, which is a project that is intended to support a CCUS process by capturing carbon dioxide, transporting captured carbon or storing or using captured carbon. This Guide applies conclusively to the engineering and scientific matters involved in determining whether a particular process is a CCUS process, whether a particular property is Class 57 Property or Class 58 Property, or whether particular equipment is Dual-use Property.

The definitions for Classes 57 and 58 can be found in Section 1.5.1. The definition for dual-use equipment can be found in Section 1.6.1.

This Guide provides information on common types of technologies for which equipment would be Class 57 Property, Class 58 Property, or Dual-use Property. Due to the segmented nature of a CCUS process (see Figure 1.4-1), more than one technology listed in this Guide may be relevant for a CCUS project. Property associated with various technologies may also be subject to different CCUS tax credit rates. Please refer to all applicable sections of the Guide for guidance on Class 57 Property, Class 58 Property, and Dual-use Property and for the delineation of process boundaries.

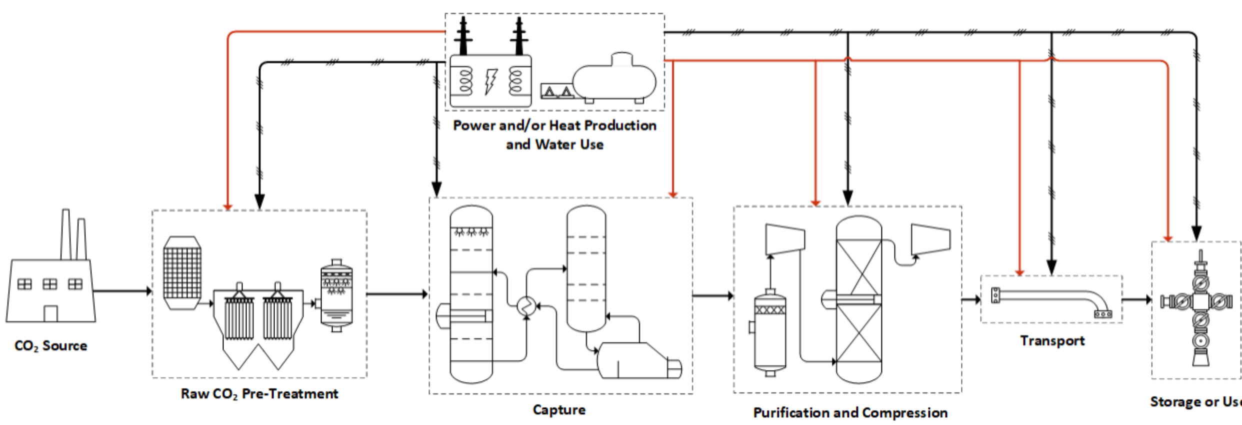


Figure 1.4-1: General schematic of the CCUS value chain.

Figure Text Description: Schematic showing major CCUS processes starting from a CO_2 point source, including pre-treatment, carbon capture, purification and compression, transport and finally storage or use, while also including heat and electricity needed for all processes.

1.4.1 Eligibility Requirements for the CCUS Tax Credit

To be eligible for the CCUS tax credit, a cost must be a ***qualified CCUS expenditure***. Qualified CCUS expenditures include the cost to acquire Class 57 Property, Class 58 Property, and Dual-use Property in respect of a ***qualified CCUS project***.

Please refer to the CCUS ITC website for information on the conditions that must be met for a CCUS project to be considered a qualified CCUS project.

Expenditures are considered qualified CCUS expenditures in proportion to the quantity of captured CO_2 the project is expected to support for storage or use in eligible uses. Eligible uses include dedicated geological storage and storage in concrete. Ineligible uses include any other storage or use that is not an eligible use, including enhanced oil recovery. The emission of captured carbon into the atmosphere (other than for the purposes of system integrity or safety or incidental emission made in the ordinary course of operations) is also an ineligible use.

Please refer to the CCUS ITC website for information on eligible and ineligible uses.

1.4.2 Amount of the CCUS Tax Credit

A taxpayer's CCUS tax credit for a taxation year is the total of all amounts each of which is a qualified CCUS expenditure incurred by the taxpayer to acquire eligible property in the year multiplied by the applicable ***specified percentage***. The specified percentage is different depending on the type of qualified CCUS expenditure. For a ***qualified carbon capture expenditure***, the rate also varies based on whether the carbon is captured directly from the ambient air or from other sources that would otherwise release the CO_2 into the atmosphere. From 2022 through 2030, the CCUS tax credit rates are set at:

- 60 percent for a qualified carbon capture expenditure incurred to capture CO_2 directly from the ambient air (i.e., qualified carbon capture expenditures in direct air capture projects);
- 50 percent for a qualified carbon capture expenditure incurred to capture CO_2 from other sources that would otherwise release the CO_2 into the atmosphere; and
- 37.5 percent for a ***qualified carbon transportation expenditure***, ***qualified carbon storage expenditure***, or ***qualified carbon use expenditure***.

These rates are reduced by half for the period from 2031 through 2040.

The applicable rate for the CCUS tax credit of a taxpayer who plans to claim or has claimed the CCUS tax credit is the specified percentage minus 10 percentage points unless the taxpayer elects in prescribed form and manner to meet the prevailing wage requirements and the apprenticeship requirements under subsection 127.46(3) and (5) of the Income Tax Act for each taxation year during which preparation or installation of the specified property occurs. These labour requirements apply in respect of specified property prepared or installed on or after November 28, 2023.

Projects that capture carbon from biomass and do not capture CO_2 directly from ambient air, like bioenergy carbon capture and storage (BECCS), do not constitute direct air capture technologies and; therefore, may only be eligible for up to a 50 percent CCUS tax credit rate (reduced to 25 percent for the period from 2031 through 2040).

1.4.3 Determination of Capital Cost

Capital cost of property is an income tax concept that generally reflects the taxpayer's full cost of acquiring the property and includes:

- legal, accounting, engineering or other fees incurred to acquire the property;
- site preparation, delivery, installation, testing, or other costs incurred to put the property into service; and
- in the case of a property a taxpayer manufactures for their own use, material, labour and overhead costs reasonably attributable to the property, but not any profit which might have been earned had the asset been sold.

More information can be found in the CRA's Income Tax Folio S3-F4-C1, *General Discussion of Capital Cost Allowance*.

It should be noted that expenditures incurred for a ***preliminary CCUS work activity***, that may be considered part of the capital cost of a property, are not considered qualified CCUS expenditures and would be ineligible for the CCUS tax credit.

1.4.4 Determination of CCUS Project

As part of the qualified CCUS project determination, the Minister of National Revenue may, in consultation with the Minister of Natural Resources, determine that one or more CCUS projects is one project or multiple projects. Any determination, as mentioned above, is deemed to result in the CCUS project or CCUS projects, being one project or multiple projects, as the case may be.

Please refer to the CCUS ITC website for guidance in the delineation of CCUS projects.

In addition, the Minister of Natural Resources may request from a taxpayer all reasonable documentation and information necessary for the Minister to fulfill their responsibilities in respect of the CCUS tax credit, including final detailed engineering designs. The Minister may refuse to verify an expenditure or issue an initial project evaluation or a revised project evaluation if such documentation or information is not provided by the taxpayer on or before the day that is 180 days after it was requested.

1.5 Classes 57 and 58

1.5.1 Class 57 Property and Class 58 Property

As stated in Class 57 in Schedule II of the Regulations, for inclusion in Class 57, property must be part of a CCUS project of a taxpayer and be :

a) equipment that is not expected to be used for hydrogen production, natural gas processing, or acid gas injection and that

   i. is not oxygen production equipment and is to be used solely for capturing carbon dioxide (A) that would otherwise be released into the atmosphere, or (B) directly from the ambient air;

   ii. prepares or compresses captured carbon for transportation;

   iii. generates or distributes electrical energy, heat energy, or a combination of electrical or heat energy, that directly and solely supports a qualified CCUS project, unless the equipment uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project, and for greater certainty, not including equipment that supports the qualified CCUS project indirectly by way of an electrical utility grid or distribution equipment that expands the capacity of existing distribution equipment that supports the qualified CCUS project;

   iv. is transmission equipment that solely supports a qualified CCUS project by directly transmitting electrical energy from electrical generation equipment described in subparagraph (a)(iii) to the qualified CCUS project, or

   v. delivers, collects, recovers, treats, or recirculates water, or a combination of any of those activities, that solely supports a qualified CCUS project;

b) equipment that is to be used solely for transportation of captured carbon, including equipment used for the transportation system safety and integrity;

c) equipment that is to be used solely for storage of captured carbon in a geological formation, including equipment used for the transportation system safety and integrity, but not including equipment used for enhanced oil recovery;

d) property that is physically and functionally integrated with the equipment described in any of paragraphs (a) to (c) (for greater certainty, excluding construction equipment, furniture, office equipment and vehicles) and that is ancillary equipment used solely to support the functioning of equipment described in any of paragraphs (a) to (c) within a CCUS process as part of

   i. an electrical system,

   ii. a fuel supply system,

   iii. a liquid delivery and distribution system,

   iv. a cooling system,

   v. a process material storage and handling and distribution system,

   vi. a process venting system,

vii. a process waste management system, or

viii. a utility air or nitrogen distribution system (see Section 1.5.1.1);

e) equipment used for system safety and integrity or as part of a control or monitoring system solely to support the equipment described in any of paragraphs (a) to (d) (see Section 1.5.1.2);

f) a building or other structure all or substantially all of which is used, or to be used, for the installation or operation of the equipment described in any of paragraphs (a) to (e) (see Section 1.5.1.3); or

g) property that is used solely to

i. convert another property that would not otherwise be described in paragraphs (a) to (f) if the conversion causes the other property to satisfy the description in any of paragraphs (a) to (f); or

ii. refurbish property described in any of paragraphs (a) to (f) that is part of a CCUS project of the taxpayer.

As stated in Class 58 in Schedule II of the Regulations, for inclusion in Class 58, property must be part of a CCUS project of a taxpayer and be:

a) equipment to be used solely for using captured carbon in industrial production (including for enhanced oil recovery);

b) property that is physically and functionally integrated with the equipment described in paragraph (a) (for greater certainty, excluding construction equipment, furniture, office equipment and vehicles) and that is ancillary equipment used solely to support the functioning of equipment described in paragraph (a) within a CCUS process as part of

i. an electrical system,

ii. a fuel supply system,

iii. a liquid delivery and distribution system,

iv. a cooling system,

v. a process material storage and handling and distribution system,

vi. a process venting system,

vii. a process waste management system, or

viii. a utility air or nitrogen distribution system; (see Section 1.5.1.1)

c) equipment that is part of a control, monitoring or safety system solely to support the equipment described in paragraph (a) or (b); (see Section 1.5.1.2)

d) a building or other structure all or substantially all of which is used, or to be used, for the installation or operation of equipment described in any of paragraphs (a) to (c); (see Section 1.5.1.3); or

e) property that is used solely to

i. convert another property that would not otherwise be described in any of paragraphs (a) to (d) if the conversion causes the other property to satisfy the description in any of paragraphs (a) to (d); or

ii. refurbish property described in any of paragraphs (a) to (d) that is part of a CCUS project of the taxpayer.

1.5.1.1 Ancillary Equipment

Examples of ancillary equipment that may be considered Class 57 Property as described in Class 57 paragraph (d) and Class 58 Property as described in Class 58 paragraph (b) include the following:

- equipment that is part of an electrical system to be used for providing electrical power to Class 57 Property or Class 58 Property, such as power wires and cables, conduits, raceways and cable trays, push-button stations, welding and power receptacles, and grounding and instrument wires and cables;
- equipment that is part of a fuel supply system to be used for supplying fuel to fuel-fired equipment, such as piping, valves, conveyors, and hoppers;
- equipment that is part of a liquid delivery and distribution system to be used for circulating liquids within the CCUS process, such as piping, holding and temporary storage tanks, loading and unloading equipment (e.g., top and bottom loading arms and loaders, chemical hoses, pumps, vapour recovery lines, valves, joints, fittings), and mechanical circulation equipment;
- equipment that is part of a cooling system to be used for circulating cooling fluid to and from the CCUS process, such as pumps, compressors, coolers, cooling towers, storage tanks, and filters;
- equipment that is part of a process material storage and handling and distribution system to be used for holding, loading and unloading, and circulating materials, such as piping, ducting, holding and temporary storage tanks, loading and unloading equipment (e.g., top and bottom loading arms and loaders, chemical hoses, pumps, vapour recovery lines, valves, joints, fittings), conveyers, hoppers, reclaimers, and mechanical circulation equipment;
- equipment that is part of a process venting system to be used for venting gaseous impurities and CO_2-lean gases (e.g., vent stacks, exhaust stacks, emission control equipment), such as equipment that is used for collecting liquids or other impurities as part of the venting process and mechanical circulation equipment that is used to facilitate venting;
- equipment that is part of a process waste management system to be used for removing waste generated by the CCUS process, such as drain tanks, filters, neutralization basins, pumps, waste effluent handling, separators, condensers, interceptor tanks, and conveyors; and
- equipment that is part of a utility air or nitrogen distribution system to be used for operating process controls and instrumentation in a CCUS process, such as piping, compressors, coolers, and dryers.

1.5.1.2 System Safety, Integrity, Monitoring, and Control Equipment

Examples of monitoring and control equipment that may be considered Class 57 Property as described in Class 57 paragraph (e) and Class 58 Property as described in Class 58 paragraph (c) include the following:

- process safety and integrity equipment that is to be used for reducing the danger of hazardous elements to personnel and equipment that arise from the operation of the CCUS process; and
- monitoring and control equipment that may include air emission monitoring, flue gas composition monitoring, geological storage conformance monitoring, process control systems and associated instruments, sensors, meters, actuators, gauges, supervisory control and data acquisition systems, programmable logic controllers, CO_2 leak detection equipment, electrical panel boxes, cables, sampling ports and lines, breakers, and switchgears.

1.5.1.3 Buildings and Other Structures

Class 57 paragraph (f), Class 58 paragraph (d), and dual-use definition paragraph (c) include buildings and other structures all or substantially all (generally meaning at or above a threshold of 90%) of which is used, or to be used, for the installation or operation of equipment that is described in certain paragraphs of Class 57, Class 58, or the definition of dual-use equipment, as applicable. To be considered Class 57 Property, Class 58 Property, or dual-use property, the buildings or other structures would have to meet this “all or substantially all” threshold.

For buildings or structures which do not meet the requirements for all or substantially all of the space to be solely for either Class 57 or Class 58 property, paragraph (f) of Class 57 can be applied when all or substantially all of the structure is used for the combination of property described in Class 57 (a) to (e), Class 58 (a) to (e), or dual-use equipment (a), (b) or (c)(i).

The cost of property used solely to convert existing buildings or other structures such that they would be all or substantially all used for the installation or operation of equipment that is described in Class 57, Class 58, or the definition of dual-use equipment would be included in subparagraph (g)(i) of Class 57, subparagraph (e)(i) of Class 58, or subparagraph (c)(iii) of the dual-use definition, as applicable**.**

Examples of buildings or other structures that may be Class 57 Property as described in Class 57 paragraph (f), Class 58 Property as described in Class 58 paragraph (d), or dual-use property as defined in dual-use definition subparagraph (c)(ii), may include the following:

- control rooms, shelters for electrical substations or compressors, and office buildings, laboratories, warehouses, and other similar buildings or other structures.

An example of a building or other structure that meets the all or substantially all threshold is shown in Figure 1.5-1. Here, 95 percent of the building footprint (A_{total}) is used for the operation of Class 57 Property or Class 58 Property (A_{CCUS}), while the other 5 percent of the building footprint is used for the operation of ineligible equipment. This results in A_{CCUS}/A_{total} = 0.95, making the building or other structure Class 57 Property or Class 58 Property.

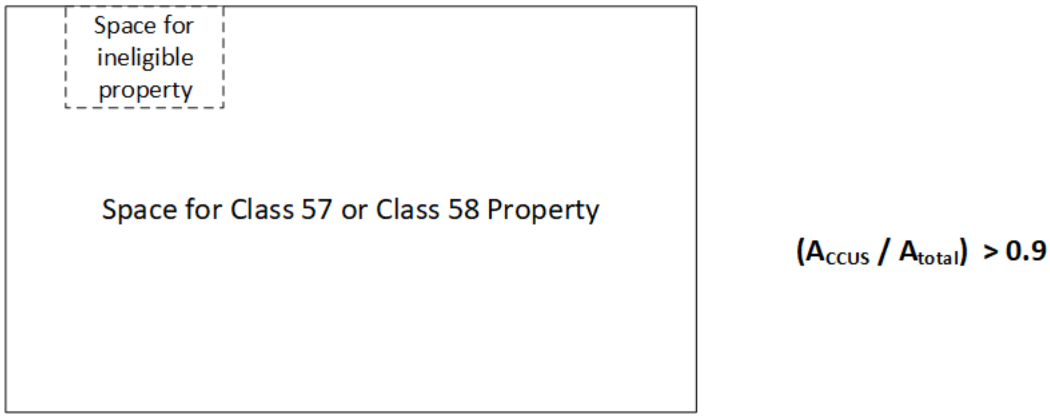


Figure 1.5-1: Example diagram of floorspace allotment for a building or structure that is Class 57 Property or Class 58 Property.

Figure Text Description: Diagram of an eligible structure where substantially all (more than 90%) of the floorspace is used for the CCUS property, with only a small portion used for ineligible process.

An example of a building or other structure that would not meet the all or substantially all threshold is shown in Figure 1.5-2. Here, 70 percent of the building footprint (A_{total}) is used to support the operation of Class 57 Property or Class 58 Property (A_{ccus}). The other 30 percent of the building footprint is used to support ineligible equipment that is not part of a CCUS project. This results in A_{CCUS}/A_{total} = 0.7, making the building or other structure ineligible property.

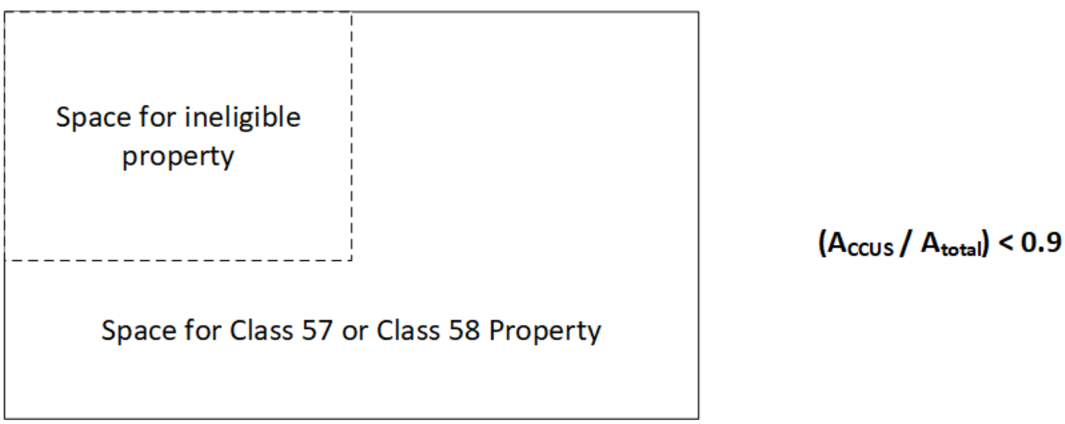


Figure 1.5-2: Example diagram of floorspace allotment for a building or other structure that is ineligible property.

Figure Text Description: Diagram of a structure where space for non-CCUS property is significant, and therefore the structure is not substantially all used for CCUS property and would be ineligible property.

In the case of a CCUS retrofit where CCUS equipment is applied to an existing emitting facility, unless new and required to support the addition of CCUS equipment, buildings and other structures would not be eligible.

Example 1: A 300 km CO_2 pipeline is being constructed to transport supercritical CO_2 from a capture facility to a storage facility where the CO_2 is injected deep underground in dedicated geological storage. Due to the length of the pipeline, a booster station is required near the 200 km mark of the pipeline. To allow workers to operate controls for the booster station under shelter from the weather elements, a small 10 m^2 building is being built on the booster station site. This shelter contains control equipment for the booster station and is not used for housing. Since this building is dedicated to the operation of the booster station which is used solely for the purpose of transporting CO_2 to an injection site, the building meets the all or substantially all threshold and is therefore Class 57 Property.

1.6 Dual-Use Equipment

1.6.1 Dual-Use Property

Equipment described in Class 57 subparagraphs (a)(iii)-(v) must solely support a qualified CCUS project. Further, supporting equipment such as ancillary equipment may generally be eligible if it used solely to support equipment described in subparagraphs (a)(iii)-(v). Some equipment that does not solely support a qualified CCUS project may be eligible for the CCUS tax credit if it is described in the definition of dual-use equipment (referred to as "Dual-use Property").

Dual-use equipment means property, other than property described in Class 57 or 58 of Schedule II to the Income Tax Regulations, that is part of a CCUS project of a taxpayer and that is described in any of the following paragraphs (and, in the case of property acquired before the first day of commercial operations of the CCUS project, is verified by the Minister of Natural Resources as being described in any of the following paragraphs):

a) equipment that is not used for natural gas processing or acid gas injection, and that
   - i. generates electrical energy, heat energy or a combination of electrical and heat energy, if more than 50% of either the electrical energy or heat energy that is expected to be produced over the total CCUS project review period, based on the most recent project plan, is expected (not including equipment that supports the qualified CCUS project indirectly by way of an electrical utility grid) to directly support
     - A. a qualified CCUS project, unless the equipment uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project, or
     - B. a qualified clean hydrogen project as defined in subsection 127.48(1), unless the equipment uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project;
   - ii. delivers, collects, recovers, treats or recirculates water, or a combination of any of those activities, in support of a qualified CCUS project,
   - iii. is equipment that directly transmits electrical energy from a system described in subparagraph (a)(i) to a qualified CCUS project and more than 50% of the electrical energy to be transmitted by the equipment over the total CCUS project review period, based on the most recent project plan, is expected to support the qualified CCUS project or a qualified clean hydrogen project as defined in subsection 127.48(1), or

iv. is equipment that distributes electrical or heat energy;

b) equipment that is physically and functionally integrated with the equipment described in paragraph (a) (for greater certainty, excluding construction equipment, furniture, office equipment and vehicles) and that is ancillary equipment used solely to support the functioning of equipment described in paragraph (a) within a CCUS process as part of,

i. an electrical system,

ii. a fuel supply system,

iii. a liquid delivery and distribution system,

iv. a cooling system,

v. a process material storage and handling and distribution system,

vi. a process venting system,

vii. a process waste management system, or

viii. a utility air or nitrogen distribution system;

c) property that is

i. used as part of a control, monitoring or safety system solely to support the equipment described in paragraphs (a) or (b),

ii. a building or other structure all or substantially all of which is used, or to be used, for the installation or operation of equipment described in paragraph (a), (b), or subparagraph (i), or

iii. used solely to convert another property that would not otherwise be described in paragraph (a) or (b) or subparagraphs (i) and (ii) if the conversion causes the other property to satisfy the description in the paragraphs (a) or (b) or subparagraphs (i) or (ii); or

d) equipment used solely to refurbish property described in paragraphs (a) or (b) or subparagraphs (c)(i) and (ii) that is part of the CCUS project of the taxpayer.

Examples of dual-use equipment include, but are not limited to, property described in Section 1.6.1 of this Guide.

The capital cost of dual-use equipment is considered a qualified carbon capture expenditure and therefore eligible for the CCUS tax credit on a prorated basis in proportion to the percentage of the expected energy balance or material balance to be used in a qualified CCUS project over the project's total CCUS project review period.

There are two relevant ratios. First, certain dual-use equipment must meet or exceed a 50% test referred to, below, as the "dual-use factor". If that is achieved, then the cost of dual-use equipment is pro-rated using the "CCUS factor" described below so that the CCUS-related portion may be a qualified expenditure while the remaining portion of the cost is not a qualified expenditure. The dual-use factor and the CCUS factor are very similar, except where the equipment also supports eligible hydrogen production and/or the equipment produces both electrical and heat energy. For example, where a dual-use factor is 60%, in some cases the CCUS factor may also be 60%.

1.6.2 Calculation of Dual-Use Equipment Factors

1.6.2.1 Heat Generation Equipment:

For heat generation equipment to be Dual-use Property, it must be property that is described in subparagraph (a)(i) of the definition of dual-use equipment.

The dual-use factor for the heat generation equipment must exceed 50%, based on the project's most recent project plan. The dual-use factor is calculated as the ratio of 1) the amount of heat energy expected to be produced for a qualified CCUS project or a qualified clean hydrogen project, disregarding equipment that uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project, and 2) the total amount of heat energy expected to be produced, over the project's total CCUS project review period.

If the heat generation equipment is eligible, a CCUS factor must be calculated to determine the proportion of the capital cost of Dual-use Property that would be considered a qualified carbon capture expenditure.

The CCUS factor for Dual-use Property will be calculated as the ratio of heat produced by heat generation equipment that is expected to be used in a qualified CCUS project and the total net heat that is expected to be produced, on an energy basis and without regard to heat energy produced and consumed by the equipment in the process of producing heat energy, based on the project's most recent project plan, that is:

CCUS factor = A/B

> **A** = amount of heat energy that is expected to be produced for use in a qualified CCUS project over the project's total CCUS project review period (GJ)
>
> **B** = total net amount of heat energy that is expected to be produced by the heat generation equipment over the project's total CCUS project review period (without regard to heat energy produced and consumed by the equipment in the process of producing heat energy) (GJ)

The values for A and B should be calculated as totals for the project's total CCUS project review period, taking into account variable plant operation such as maintenance downtime. In addition to applying to the heat generation equipment itself, this CCUS factor will apply to Dual-use Property described in paragraphs (b) to (d) of the definition of dual-use equipment (e.g., ancillary equipment, monitoring and control equipment, refurbishment equipment). Heat that is recovered from a CCUS process and reused in a different application should not be included in this calculation; only the original destination of the heat energy should be considered. For equipment where all the heat is delivered to a qualified CCUS project, the equipment is considered to be used solely for the qualified CCUS project, and a CCUS factor does not need to be calculated.

Example: A steam boiler generates steam by combusting natural gas that amounts to 3,000,000 GJ over the project's total CCUS project review period (B). 2,450,000 GJ of the heat produced by the steam boiler is used in a qualified CCUS project (A), such as a stripper reboiler for CO_2 stripping. However, 550,000 GJ of the remaining heat is used to provide energy to a non-CCUS process. In this scenario, the total heat energy generated that is used in a qualified CCUS project or a qualified clean hydrogen project is greater than 50%, making it Dual-use Property (provided the other conditions are also met). The steam boiler CCUS factor is A/B = 0.82. This CCUS factor would be applied to the steam boiler, as well as the Dual-use Property used to support the heat generation process such as ancillary equipment described in paragraphs (b) of the definition of dual-use equipment.

1.6.2.2 Power Generation Equipment:

For power generation equipment to be Dual-use Property, it must be property that is described in subparagraph (a)(i) of the definition of dual-use equipment.

The dual-use factor for the power generation equipment must exceed 50%, based on the project's most recent project plan. The dual-use factor is calculated as the ratio of 1) the amount of power expected to be produced for a qualified CCUS project or for a qualified clean hydrogen project, disregarding equipment that uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project, and 2) the total amount of power expected to be produced, over the project's total CCUS project review period.

If the power generation equipment is eligible, a CCUS factor must be calculated to determine the proportion of the capital cost of Dual-use Property that would be considered a qualified carbon capture expenditure.

The CCUS factor for Dual-use Property will be calculated as the ratio of electrical energy produced by power production equipment that is expected to be used by a qualified CCUS project and the total net electrical energy expected to be produced, without regard to electrical energy produced and consumed by the equipment in the process of producing electrical energy, based on the project's most recent project plan, that is:

CCUS factor = C/D

> **C** = amount of electrical energy that is expected to be produced for use in a qualified CCUS project over the project's total CCUS project review period (MWh)
>
> **D** = total net amount of electrical energy that is expected to be produced by the power generation equipment over the project's total CCUS project review period (without regard to electrical energy produced and consumed by the equipment in the process of producing electrical energy) (MWh)

The values for C and D should be calculated as totals for the project's total CCUS project review period, taking into account variable plant operation such as maintenance downtime. In addition to applying to the power production equipment itself, this CCUS factor will apply to Dual-use Property described in paragraphs (b) to (d) of the definition of dual-use equipment (e.g., ancillary equipment, monitoring and control equipment, refurbishment equipment). For equipment where all the power is produced for use in a qualified CCUS project, the equipment is considered as being used solely for the qualified CCUS project and a CCUS factor does not need to be calculated.

Example: A steam turbine generates electricity by combusting natural gas that amounts to 1,200,000 MWh over the project's total CCUS project review period (D). 650,000 MWh of the electricity produced by the steam turbine is used in a qualified CCUS project (C), such as a compressor train for CO_2 purification and compression. However, 550,000 MWh of the remaining electricity was used to provide power to a non-CCUS process. In this scenario, the total electrical energy generated that is used in a qualified CCUS project or a qualified clean hydrogen project is greater than 50%, making it Dual-use Property (provided the other conditions are met). The steam turbine CCUS factor is C/D = 0.54. This CCUS factor would be applied to the steam turbine, as well as the Dual-use Property used to support the power generation process such as ancillary equipment described in paragraph (b) of the definition of dual-use equipment.

1.6.2.3 Combined Heat and Power Production:

For combined heat and power generation equipment to be Dual-use Property, it must be property that is described in subparagraph (a)(i) of the definition of dual-use equipment.

For combined heat and power generation equipment, the energy balance for either electrical energy or heat can be used to determine if it is Dual-use Property. The dual-use factor for the electrical energy or heat generation equipment must exceed 50%, based on the project's most recent project plan. The dual-use factor is calculated as the ratio of 1) the amount of electrical energy or heat energy expected to be produced for a qualified CCUS project or for a qualified clean hydrogen project, disregarding equipment that uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project, and 2) the total amount of electrical energy or heat energy expected to be produced, over the project's total CCUS project review period.

If the combined heat and power generation equipment is eligible, a CCUS factor must be calculated to determine the proportion of the capital cost of Dual-use Property that would be considered a qualified carbon capture expenditure.

The CCUS factor for Dual-use Property will be calculated as the ratio of electrical energy and heat produced by combined heat and power generation equipment that is expected to be used by a qualified CCUS project and the total net electrical energy and heat produced, on an energy basis and without regard for heat and electrical energy produced and consumed by the equipment in the process of producing heat and electrical energy, based on the project's most recent project plan, that is:

$$\textbf{CCUS factor} = \frac{\mathbf{E}}{\mathbf{F}} = \frac{\mathbf{G} + (\mathbf{H} * \Theta)}{\mathbf{J} + (\mathbf{K} * \Theta)}$$

E = amount of heat and electrical energy that is expected to be produced for use in a qualified CCUS project over the project's total CCUS project review period (GJ)

F = total net amount of heat and electrical energy that is expected to be produced by the combined heat and power generation equipment over the project's total CCUS project review period (without regard for heat and electrical energy produced and consumed by the equipment in the process of producing heat and electrical energy) (GJ)

G = amount of heat energy that is expected to be produced for use in a qualified CCUS project over the project's total CCUS project review period (GJ)

H = amount of electrical energy that is expected to be produced for use in a qualified CCUS project over the project's total CCUS project review period (MWh)

Θ = a conversion factor of 3.6 GJ/MWh to convert electrical energy (MWh) into heat energy (GJ)

J = total net amount of heat energy that is expected to be produced by the combined heat and power generation equipment over the project's total CCUS project review period (without regard for heat energy produced and consumed by the equipment in the process of producing heat energy) (GJ)

K = total net amount of electrical energy that is expected to be produced by the combined heat and power generation equipment over the project's total CCUS project review period (without regard for electrical energy produced and consumed by the equipment in the process of producing electrical energy) (MWh)

All values should be calculated as totals for the project's total CCUS project review period, taking into account variable plant operation such as maintenance downtime. In addition to applying to the combined heat and power generation equipment itself, this CCUS factor will apply to all Dual-use Property described in paragraphs (b) to (d) of the definition of dual-use equipment (e.g., ancillary equipment, monitoring and control equipment, refurbishment equipment). Heat that is recovered from a CCUS process and reused in a different application should not be included in this calculation; only the original destination of the heat energy should be considered. For equipment where all the heat and power is delivered to a qualified CCUS project, the equipment is considered as being used solely for a qualified CCUS project and a CCUS factor does not need to be calculated.

Example: Combined heat and power generation equipment combusts natural gas and generates total electrical and heat in the amount of 57,600,000 GJ (16,000,000 MWh) as output from the heat and power generation equipment over the project's total CCUS project review period (F). Of that amount, 6,400,000 MWh is electrical energy that is produced using a generator (K) and the rest is useful heat energy that is recovered using a heat recovery steam generator, amounting to 34,560,000 GJ of heat energy (J). A qualified CCUS project consumes 1,500,000 MWh of electrical energy (H) and 20,000,000 GJ of heat energy (G), for a total of 25,400,000 GJ of energy used for the CCUS process (E). The remainder of the generated energy is used to support a qualified clean hydrogen project. Furthermore, the CO_2 produced during energy generation is subsequently captured and permanently stored. In this scenario, the total heat energy generated that is used in a qualified CCUS project or a qualified clean hydrogen project is greater than 50% (34,560,000 GJ / 34,560,000 GJ = 1.0), and, therefore, it may meet the definition of dual-use equipment (provided the other conditions are met). The combined heat and power generation CCUS factor is E/F = 0.44. The CCUS factor of 0.44 would be applied to the gas turbine, generator, and heat recovery steam generator, as well as the Dual-use Property used to support the combined heat and power generation equipment such as ancillary equipment described in paragraph (b) of the definition of dual use equipment.

1.6.2.4 Power Distribution

For power distribution equipment to be Dual-use Property, it must be property that is described in subparagraph (a)(iv) of the definition of dual-use equipment.

The CCUS factor for this Dual-use Property will be determined as the ratio of 1) electrical energy expected to be distributed by the electrical distribution equipment (or if it is distribution equipment that expands the capacity of existing equipment, the electrical energy expected to be distributed by the existing and new equipment) for use in a qualified CCUS project over the project's total CCUS project review period and 2) the total net amount of electrical energy expected to be distributed by the equipment (or the existing and new equipment), without regard to electrical energy consumed by the equipment in the process of distributing electrical energy, in that period.

Each segment of the electricity distribution equipment, namely primary substations, secondary substations, and distribution points could have different CCUS factors. Primary substations are regarded as the equipment that transforms high voltage (transmission power) electricity into medium voltage (distribution power) electricity and distributes it to secondary substations. Secondary substations are regarded as the equipment that transforms medium voltage electricity into low voltage (utilization power) electricity and distributes it to distribution points. Distribution points are regarded as the equipment associated with a plant building that transforms and distributes the low voltage electricity to plant equipment as required. The power lines that supply the secondary substations and distribution points with electricity shall have a CCUS factor equal to the secondary substation or distribution point they power. The CCUS factors are described on an energy basis, based on the project's most recent project plan, that is:

$$\textbf{Distribution Point CCUS Factor} = \frac{\mathbf{L}}{\mathbf{M}}$$

L = amount of electrical energy that is expected to be distributed from the distribution point for use in a qualified CCUS project over the project's total CCUS project review period (MWh)

M = total net amount of electrical energy that is expected to be distributed from the distribution point over the project's total CCUS project review period (without regard to electrical energy consumed by the equipment in the process of distributing electrical energy) (MWh)

$$\textbf{Secondary Substation CCUS Factor} = \frac{\mathbf{1}}{\mathbf{N}}\sum_{\mathbf{i=1}}^{\mathbf{n}} \boldsymbol{L_i}$$

n = the number of distribution points

i = the distribution point index

L_i = amount of electrical energy that is expected to be distributed from distribution point *i* for use in a qualified CCUS project over the project's total CCUS project review period (MWh)

N = total net amount of electrical energy that is expected to be distributed from the secondary substation over the project's total CCUS project review period (without regard to electrical energy consumed by the equipment in the process of distributing electrical energy) (MWh)

$$\textbf{Primary Substation CCUS Factor} = \frac{\mathbf{1}}{\mathbf{P}} \sum_{\mathbf{j=1}}^{\mathbf{m}} \sum_{\mathbf{i=1}}^{\mathbf{n}} (\mathbf{L_{j,i}})$$

m = the number of secondary substations

n = the number of distribution points

j = the secondary substation index

i = the distribution point index

$\mathbf{L_{j,i}}$ = amount of electrical energy that is expected to be distributed from distribution point *i* and secondary substation *j* for use in a qualified CCUS project over the project's total CCUS project review period (MWh)

P = total net amount of electrical energy that is expected to be distributed from the primary substation over the project's total CCUS project review period (without regard to electrical energy consumed by the equipment in the process of distributing electrical energy) (MWh)

All values should be calculated as totals for the project's total CCUS project review period, taking into account variable plant operation such as maintenance downtime. In addition to applying to the electricity distribution equipment itself, this CCUS factor will apply to all Dual-use Property described in paragraphs (b) to (d) of the definition of dual-use equipment (e.g., ancillary equipment, monitoring and control equipment, refurbishment equipment). Each primary and secondary substation and distribution point that distributes power to a qualified CCUS project will have a separate CCUS factor calculated. For equipment where all the power is distributed for use in a qualified CCUS project, the equipment is considered to be solely for the qualified CCUS project and a CCUS factor does not need to be calculated.

Example 1: A CCUS capture facility is installed on an ethanol plant. The electrical requirement of the qualified CCUS project is 10,000,000 MWh (L). There is an existing primary substation that provides power to the ethanol plant, and the primary substation is sized to accommodate this additional capacity requirement. However, an additional secondary substation must be built to supply power to the qualified CCUS project. Of this secondary substation, 10,000,000 MWh (L) will be delivered to the qualified CCUS project, and 5,000,000 MWh will be delivered to ethanol plant equipment. In total, the secondary substation will deliver 15,000,000 MWh of electricity (N). The transmission lines and primary substation would not be eligible for the CCUS tax credit as they were already in place prior to construction. The secondary substation and distribution power lines would have a CCUS factor of 0.67, and the low-voltage power lines and low voltage supply systems used to distribute electricity to the CCUS equipment would be considered used solely by the qualified CCUS project.

Example 2: A CCUS capture facility is installed on a cement kiln. The electrical requirement of the qualified CCUS project is 20,000,000 MWh (L). A primary substation exists in the region, but it does not have adequate capacity to service the increased demand. An expansion is installed to increase the substation's capacity from 20,000,000 MWh to 40,000,000 MWh (P) over the total CCUS project review period. No new transmission lines are needed. A new secondary substation is installed to solely service the qualified CCUS project. In this scenario, the primary substation expansion would have a CCUS factor of 0.5 because after the expansion the substation would deliver 20,000,000 MWh to the CCUS project and 20,000,000 MWh to the cement kiln. The secondary substation would be considered used solely by the qualified CCUS project, as would the distribution lines and low voltage power lines. These systems would therefore not be subject to a CCUS factor.

Example 3: A CCUS capture facility with a 20,000,000 MWh (L) electrical requirement over the total CCUS project review period is installed on a fertilizer plant. A wind farm is installed nearby to provide power for the CCUS process and to sell power to the grid. As the wind farm provides intermittent capacity, the existing primary and secondary substations are used to support the qualified CCUS project with grid electricity. The existing primary substation does not require an expansion, but the secondary substation does. Of the wind farm's total capacity of 15,000,000 MWh (D), it provides 10,000,000 MWh (C) to the CCUS project and 5,000,000 MWh is sold to the grid. The primary substation provides 30,000,000 MWh to the fertilizer plant and 10,000,000 MWh ($L_{primary}$)to the CCUS project, for a total capacity of 40,000,000 MWh (P). The secondary substation that services the CCUS project is expanded from a total capacity of 5,000,000 MWh to a total capacity of 25,000,000 MWh (N) over the total CCUS project review period. This secondary substation accommodates the CCUS project's electricity generated by the wind farm, which does not need to be increased in voltage. In this scenario, the wind farm would have a CCUS factor of 0.67, as calculated by the CCUS factor formula for power generation equipment (C/D = 10,000,000 MWh / 15,000,000 MWh). The secondary substation expansion would have a CCUS factor of 0.8, as would the distribution power lines between the primary and secondary substations (L/N = 20,000,000 MWh / 25,000,000 MWh). The distribution line connecting the wind farm to the secondary substation would also have a CCUS factor of 0.8. The low voltage power lines connecting the secondary substation to the CCUS project are considered used solely by the CCUS project. The step-up transformers and associated transmission lines required to sell electricity from the wind farm to the grid would be considered ineligible.

1.6.2.5 Power Transmission

For power transmission equipment to be Dual-use Property, it must be property that is described in subparagraph (a)(iii) of the definition of dual-use equipment.

The dual-use factor for the power transmission equipment must exceed 50%, based on the project's most recent project plan. The dual-use factor is calculated as the ratio of 1) the amount of power expected to be transmitted for a qualified CCUS project or for a qualified clean hydrogen project, as long as emissions are abated by a qualified CCUS project, and 2) the total amount of power expected to be transmitted, over the project's total CCUS project review period. If the power transmission equipment is eligible, a CCUS factor must be calculated to determine the proportion of the capital cost of Dual-use Property that would be considered a qualified carbon capture expenditure.

The CCUS factor for this Dual-use Property is calculated as the ratio of electrical energy expected to be transmitted by the transmission equipment for use in a qualified CCUS project and the total net electrical energy expected to be transmitted, without regard to electrical energy consumed by the equipment in the process of transmitting electrical energy, based on the project's most recent project plan, that is:

CCUS factor = Q/R

> **Q** = amount of electrical energy that is expected to be transmitted from the transmission equipment for use in a qualified CCUS project over the project's total CCUS project review period (MWh)
>
> **R** = total net amount of electrical energy that is expected to be transmitted from the transmission equipment over the project's total CCUS project review period (without regard to electrical energy consumed by the equipment in the process of transmitting electrical energy) (MWh)

The values for Q and R should be calculated as totals for the project's total CCUS project review period, taking into account variable plant operation such as maintenance downtime. In addition to applying to the transmission equipment itself, this CCUS factor will apply to dual-use property described in paragraphs (b) to (d) of the definition of dual-use equipment (e.g., ancillary equipment, monitoring and control equipment, refurbishment equipment). For equipment where all the power is transmitted for use in a qualified CCUS project, the equipment is considered to be used solely for the qualified CCUS project and a CCUS factor does not need to be calculated.

Example: A hydroelectric power dam that is not connected to the grid produces 20,000,000 MWh (R) over the project's total CCUS project review period and transmits all of the power to a primary substation that services a qualified CCUS project. 12,000,000 MWh (Q) of this power is used by the qualified CCUS process and the remaining 8,000,000 MWh is used by the CO_2 source process. In this scenario, the total electrical energy transmitted that is used by a qualified CCUS project is greater than 50%, making it Dual-use Property. The CCUS factor and dual-use factor for the transmission equipment would both be 0.6 (Q/R = 12,000,000 MWh / 20,000,000 MWh). The CCUS factor and dual use factor for the hydroelectric dam would also be 0.6, as calculated by the CCUS Factor formula for power generation equipment.

1.6.2.6 Heat Distribution

For heat distribution equipment to be Dual-use Property, it must be property that is described in subparagraph (a)(iv) of the definition of dual-use equipment.

The CCUS factor for Dual-use Property is calculated as the ratio of 1) heat energy distributed by heat distribution equipment (or if it is distribution equipment that expands the capacity of existing equipment, the heat energy expected to be distributed by the existing and new equipment) that is expected to be used by a qualified CCUS project and 2) the total net amount of heat energy expected to be distributed by the equipment, without regard to heat or electrical energy consumed by the equipment in the process of distributing heat energy, throughout the project's total CCUS project review period:

CCUS factor = S/T

S = amount of heat energy that is expected to be distributed by the heat distribution equipment (or if it is distribution equipment that expands the capacity for existing equipment, the heat energy expected to be distributed by the existing and new equipment) for use in a qualified CCUS project over the project's total CCUS project review period (GJ)

T = total net amount of heat energy that is expected to be distributed by the heat distribution equipment (or if it is distribution equipment that expands the capacity for existing equipment, the existing and new equipment) over the project's total CCUS project review period (without regard to heat or electrical energy consumed by the equipment in the process of distributing heat energy) (GJ)

The values for S and T should be calculated as totals for the project's total CCUS project review period, taking into account variable plant operation such as maintenance downtime. In addition to applying to the heat distribution equipment itself, this CCUS factor will apply to dual-use property described in paragraphs (b) to (d) of the definition of dual-use equipment (e.g., ancillary equipment, monitoring and control equipment, refurbishment equipment). Heat distribution equipment is considered the equipment required to deliver heat from the heat production equipment to the equipment that requires it, including equipment required to recirculate the heating medium to the heat production system. The heat distribution system does not include the equipment that uses the heat. For systems where all the heat is distributed to a qualified CCUS project, the equipment is considered as being used solely for the qualified CCUS project, and a CCUS factor does not need to be calculated.

Example 1: A steam boiler provides 400,000,000 GJ (T) over the project's total CCUS project review period. 300,000,000 GJ is distributed to non-CCUS process equipment, and 100,000,000 GJ (S) is distributed to a qualified CCUS project. The heat distribution system CCUS factor is S/T = 0.25. It is also applied to the Dual-use Property used to support the heat distribution process such as ancillary equipment described in paragraph (b) of the definition of dual-use equipment. It should be noted that the CCUS factor only applies to the segments of the heat distribution system that are involved in the distribution of the heat to the CCUS process. The segments of the heat distribution system (*e.g.* steam distribution pipes) that are not involved in the distribution of heat to the CCUS process, are not eligible and the CCUS factor does not apply to them, even if they originate form the same heat generation plant.

Example 2: A heat distribution system is expanded to accommodate a brownfield CCUS capture plant installation. The original heat distribution system was to provide 300,000,000 GJ to non-CCUS equipment over the total CCUS project review period, and it is expanded to accommodate 500,000,000 GJ (T) over the same time period. The additional 200,000,000 GJ (S) of capacity provides heat to the qualified CCUS project. The CCUS factor of this heat distribution expansion is S/T = 0.4, and it is applied only to the equipment installed during the expansion, as well as any installed Dual-use Property used to support the heat distribution process such as ancillary equipment described in paragraph (b) of the definition of dual-use equipment.

1.6.2.7 Water Delivery, Collection, Recovery, Treatment, or Recirculation Equipment

For water delivery, collection, recovery, treatment, or recirculation equipment to be Dual-use Property, it must be property that is described in subparagraph (a)(ii) of the definition of dual-use equipment.

The CCUS factor for Dual-use Property will be calculated as the ratio of 1) water that is expected to be returned from a qualified CCUS project and 2) the total water expected to be returned to water delivery, collection, recovery, treatment, and recirculation equipment on a mass basis, based on the project's most recent project plan, that is:

CCUS factor = U/V

> **U**= mass of water that is expected to be returned from a qualified CCUS project to water delivery, collection, recovery, treatment, and recirculation equipment over the project's total CCUS project review period (tonnes)
>
> **V**= total mass of water that is expected to be returned to water delivery, collection, recovery, treatment, and recirculation equipment over the project's total CCUS project review period (tonnes)

The values for U and V should be calculated as totals for the project's total CCUS project review period, taking into account variable plant operation such as maintenance downtime. In addition to applying to the water delivery, collection, recovery, treatment, and recirculation equipment itself, this CCUS factor will apply to Dual-use Property described in paragraphs (b) to (d) of the definition of dual-use equipment (e.g. ancillary equipment, monitoring and control equipment, refurbishment equipment). For processes where all the water is returned from a qualified CCUS project, the equipment is considered to solely support a qualified CCUS project and a CCUS factor does not need to be calculated.

Example: A steam boiler that meets the definition of dual-use equipment is supported by a water delivery, collection, recovery, treatment, and recirculation process intended to recover waste energy and minimize water consumption. This water use process returns 14,000,000 tonnes of water over the project's total CCUS project review period (V), of which 6,000,000 tonnes is returned from a CCUS process (U) and 8,000,000 tonnes is returned from a non-CCUS production process. The water use process CCUS factor is U/V = 0.43. This CCUS factor would be applied to the water delivery, collection, recovery, treatment, and recirculation equipment, as well as the Dual-use Property used in the water delivery, collection, recovery, treatment, and recirculation process such as piping, instruments, and other property described in paragraphs (b) and (c) of the definition of dual-use equipment.

2 Pre-Treatment, Purification and Compression, and Power and/or Heat and Water Processes

2.1 Raw CO_2 Pre-treatment

2.1.1 Raw CO_2 Pre-treatment Processes

Raw CO_2 pre-treatment processes use equipment to pre-treat and remove impurities from an incoming raw CO_2 stream for the purpose of bringing it to specifications required for the carbon capture process.

Property that is a part of a raw CO_2 pre-treatment process, which is a subset of technology within carbon capture processes (described in Class 57 subparagraph (a)(i)), could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for capturing carbon dioxide, is not oxygen production equipment and is not equipment that is expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
    - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

2.1.2 Pertinent Class 57 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process where raw CO_2 pre-treatment is the primary technology will be based on the definitions set out in the Act and the Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 2.1.1 to be Class 57 Property. This Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, the following:

- pre-treatment equipment (e.g., desulfurizers, selective catalytic reduction reactors (SCR), catalytic converters, electrostatic precipitators, cyclones, filters) that is to be used for removing impurities from the incoming raw CO_2 streams so that the CCUS process (i.e., downstream carbon capture process) can function at its intended level of performance, including equipment for fluid reflux (e.g., reflux drums and fluid circulation equipment) when necessary;

- cooling equipment (e.g., direct contact coolers [DCCs], heat exchangers) that is to be used for reducing process stream temperature to facilitate CO_2 separation in the carbon capture process;
- mechanical fluid circulation equipment (e.g., blowers, fans, pumps) that is to be used for moving process streams and fluids;
- tanks for handling materials that are to be used for the incoming raw CO_2 pre-treatment process, including surge tanks and holding tanks for absorbent/solvent, antifoaming agents, process waste, nitrogen, and other chemicals, as well as equipment that is used to maintain the chemicals and fluids at the necessary storage conditions; and
- any other property that is described in Class 57 in relation to a carbon capture process, including, but not limited to, ancillary equipment, monitoring and control equipment, and building or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

Certain property that supports a raw CO_2 pre-treatment process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, may also be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates electrical energy in support of a qualified CCUS project;
- distribution equipment that distributes electrical energy in support of a qualified CCUS project;
- transmission equipment that transmits electrical energy in support of a qualified CCUS project; and
- water use equipment that delivers, collects, recovers, treats, or recirculates water, or a combination of any of those activities, in support of a qualified CCUS project.

2.1.3 Typical Property Not Included in Class 57

Property used in the raw CO_2 pre-treatment process that is not Class 57 Property is ineligible for the CCUS tax credit. Examples of typical property not included in Class 57 include the following:

- equipment used in a raw CO_2 pre-treatment process that is also used in a non-CCUS process (e.g., hydrogen production process, industrial process) and is therefore not used solely for a CCUS process, such as:
    - pre-treatment equipment (e.g., desulfurizers, SCRs, electrostatic precipitators, catalytic converters, filters, and similar equipment) that is used for removing impurities (e.g., H_2S, SO_x, NO_x, PM) from incoming raw CO_2 streams;
    - pre-treatment cooling equipment (e.g., DCCs, condensing economizers, intercoolers, condensers, cooling water heat exchangers, knock-out drums, dryers, and filters) that is used for cooling incoming raw CO_2 streams; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note, this list is not exhaustive and is meant to provide general guidance on typical property used in a raw CO_2 pre-treatment process that is not Class 57 Property.

2.1.4 Typical Capital Costs Included in Class 57

Typical capital costs when constructing a raw CO_2 pre-treatment process that is part of a CCUS project would include the costs provided in Table 2.1-1:

Table 2.1-1 Project cost table for raw CO_2 pre-treatment processes

Capital cost of Class 57 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. **These costs may be attributed to the following technical applications as part of a raw CO_2 pre-treatment process, provided the property is Class 57 Property such as, but not limited to, the Class 57 Property described in Section 2.1.2 or Section** 1.5.1**:**	
1	Pre-treatment equipment
2	Mechanical fluid circulation equipment
3	Cooling and heat transfer equipment
4	Electricity generation equipment – see Section 2.2 for details
5	Electricity distribution equipment – see Section 2.2 for details
6	Electricity transmission equipment – see Section 2.2 for details
7	Process water stream delivery, collection, recovery, treatment, and recirculation equipment – see Section 2.2 for details
8	Electrical system equipment
9	Liquid delivery and distribution equipment
10	Utility cooling system equipment
11	Material handling and storage and distribution system equipment, including holding tanks, conditioning equipment, and fluid transfer equipment
12	Venting system equipment
13	Process waste management system equipment
14	Compressed utility air or nitrogen system equipment
15	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
16	Process safety equipment
17	Flow control and containment equipment
18	Buildings or other structures
19	Equipment for conversion of existing property into Class 57 Property
20	Equipment for refurbishment of existing Class 57 Property

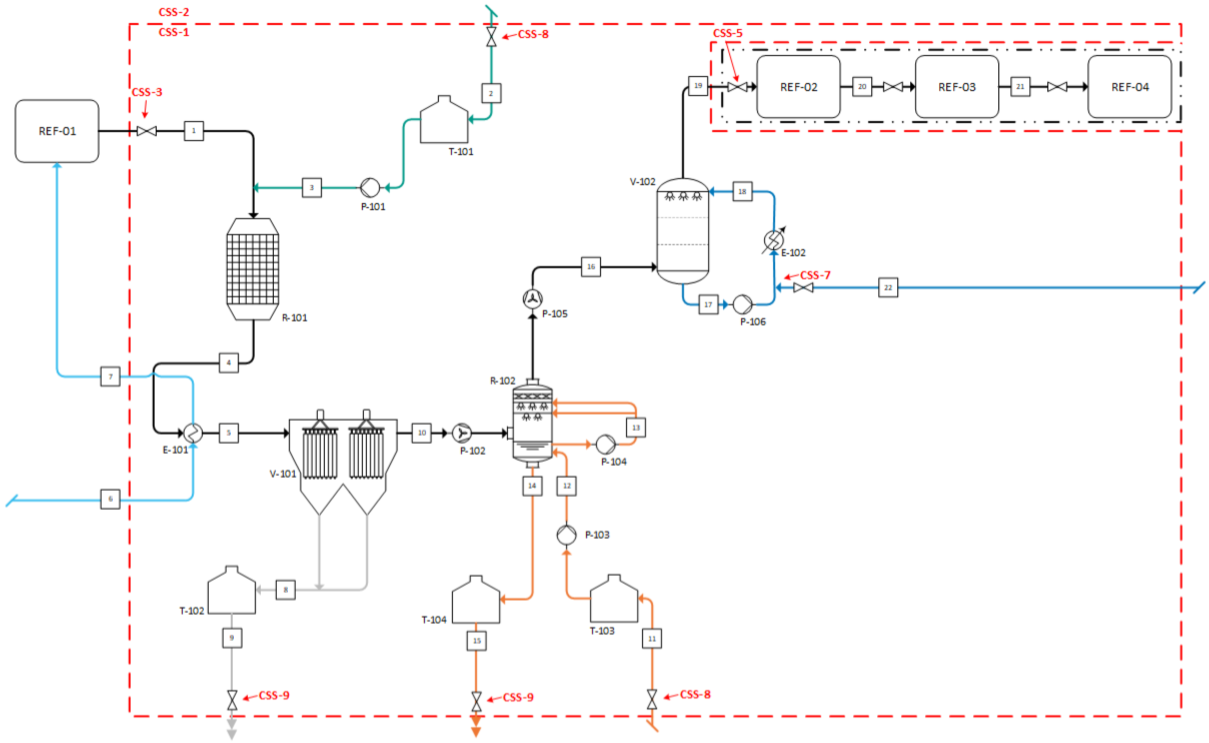
2.1.5 Schematic for Class 57 Property in a Raw CO_2 Pre-Treatment Process

Some typical elements of a CCUS process that can be used to pre-treat incoming raw CO_2 streams are shown in Figure 2.1-1. Process boundaries defined here are for a typical raw CO_2 pre-treatment process, using a schematic of a water knockout drum, electrostatic precipitator, SCR, desulfurizer, and DCC as a representative example.

However, note that the specific property that is used in a raw CO_2 pre-treatment process may depend on the level of CO_2 pre-treatment and pre-conditioning required by the type of carbon capture technology used in the CCUS process. Ultimately, whether particular property is Class 57 Property will depend on its function within the CCUS process.

Other equipment not listed may still be Class 57 Property and can include fluidized bed reactors and other novel reactors, flash, wash, and separation vessels, and, in some circumstances, supporting equipment such as cooling, heating, and fluid circulation equipment.

<u>NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 2, please refer to Section 2.4. Note that not all notes apply to each schematic.</u>



Equipment Identifier	Equipment Type	Equipment Description
E-101	Heat Exchanger	Untreated CO_2 Cooler
E-102	Heat Exchanger	Contact Water Cooler
P-101	Pump	Ammonia Pump
P-102	Blower	Electrostatic Precipitator Outlet Blower
P-103	Pump	Limestone Slurry Feed Pump
P-104	Pump	Limestone Slurry Circulation Pump
P-105	Blower	Desulfurizater Outlet Blower
P-106	Pump	Contact Water Circulation Pump
R-101	Reactor	Selective Catalytic Reactor
R-102	Reactor	Desulfurizer
T-101	Chemical Tank	Ammonia Storage Tank
T-102	Chemical Tank	Ash Storage Tank
T-103	Chemical Tank	Limestone Slurry Tank
T-104	Chemical Tank	Gypsum Tank
V-101	Precipitator	Electrostatic Precipitator
V-102	Heat Exchanger Vessel	Direct Contact Cooler

Stream Number	Stream Type
1	Raw CO_2
2	Ammonia Tank Fill Line
3	Ammonia Feed
4	De-NOx CO_2 Stream
5	Cooled De-NOx CO_2 Stream
6	Ambient Air Inlet
7	Pre-heated Air
8	Precipitator Ash
9	Precipitator Ash Removal
10	De-ashed CO_2 Stream
11	Limestone Slurry Tank Fill Line
12	Limestone Slurry Feed
13	Limestone Slurry Circulation Line
14	Gypsum
15	Gypsum Removal
16	De-SOx CO_2 Stream
17	Contact Water Circulation
18	Cooled Direct Contact Water
19	Pretreated CO_2
20	Captured CO_2
21	Compressed and Purified CO_2
22	Feed Water

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	CO_2 Capture Process	Section 3
REF-03	CO_2 Compression and Purification	Section 2.3
REF-04	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

- CO_2
- Water
- Limestone Slurry
- Chemical
- Air
- Ash

Class 57 Property for a Raw CO_2 Pre-Treatment Process

Other Class 57 Property or Class 58 Property

Figure 2.1-1: An example of a raw CO_2 pre-treatment process.

Figure Text Description: Diagram illustrating the boundaries of a raw CO_2 pre-treatment process which begins from the CO_2 source process at CSS-3 and includes items such as heat exchangers, reactors, pumps, and blowers needed to pre-treat the CO_2 stream until it reaches CSS-5 where a CO_2 capture process begins. Boundaries for secondary streams within this process include CSS-7 for water, CSS-8 for ammonia inlet, CSS-9 for ash outlet, and CSS-8 and CSS-9 for limestone slurry streams. For notes on process boundaries for this schematic and all other schematics in Section 2, please refer to Section 2.4, but not all notes apply to each schematic.

2.2 Power and/or Heat and Water

2.2.1 Power and/or Heat Generation, Power and Heat Distribution, Power Transmission, and Water Use Processes

Power and/or heat generation processes use equipment to generate electrical energy and/or heat energy for the purpose of supporting a CCUS process. Heat distribution processes use equipment to distribute heat-carrying fluid from heat generation equipment to end-use equipment within a CCUS process. Power distribution processes use equipment to distribute electrical energy from power generation equipment to end-use equipment within a CCUS process. Power transmission processes use equipment to transmit electrical energy from power generation equipment to end-use equipment within a CCUS process. Water use processes use equipment to support the delivery, collection, recovery, treatment, and/or recirculation of water within a CCUS process.

Property that is a part of a power and/or heat generation process, power or heat distribution process, power transmission process, or water use process (described in Class 57 subparagraphs (a)(iii)-(v)) could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
  - the property generates or distributes electrical energy, heat energy, or a combination of electrical and heat energy, that directly and solely supports a qualified CCUS project, unless the equipment uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project, and for greater certainty, not including equipment that supports the qualified CCUS project indirectly by way of an electrical utility grid, or distribution equipment that expand the capacity of existing distribution equipment that supports the qualified CCUS project, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection;
  - the property is transmission equipment that solely supports a qualified CCUS project by directly transmitting electrical energy from electrical generation equipment described above to the qualified CCUS project and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection;
  - the property delivers, collects, recovers, treats, or recirculates water, or a combination of any of those activities, that solely supports a qualified CCUS project and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
  - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

Property that is a part of a power and/or heat generation process, power or heat distribution process, power transmission process, or water use process (described in subparagraphs (a)(i)-(iv) of the dual use equipment definition in section 127.44 of the Act) could be Dual-use Property if a number of conditions are met, including:

- equipment that is part of a CCUS project of a taxpayer, is not equipment used for natural gas processing or acid gas injection; and
    - the equipment generates electrical energy, heat energy or a combination of electrical and heat energy, if more than 50% of either the electrical energy or heat energy that is expected to be produced over the total CCUS project review period, based on the most recent project plan, is expected (not including equipment that supports the qualified CCUS project indirectly by way of an electrical utility grid) to directly support (A) a qualified CCUS project, unless the equipment uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project, or (B) a qualified clean hydrogen project, unless the equipment uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project;
    - the equipment delivers, collects, recovers, treats or recirculates water, or a combination of any of those activities, in support of a qualified CCUS project;
    - the equipment that directly transmits electrical energy from a system described in the first bullet of this section to a qualified CCUS project and more than 50% of the electrical energy to be transmitted by the equipment over the total CCUS project review period, based on the most recent project plan, is expected to support the qualified CCUS project or a qualified clean hydrogen project;
    - the equipment that distributes electrical or heat energy; or
    - the property is described in paragraphs (b)-(d) of the definition of dual-use equipment in section 127.44 of the Act in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide. The capital cost of Dual-use Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.6 of this Guide.

2.2.2 Pertinent Class 57 Property or Dual-use Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property or Dual-use Property within a process where it is used to provide power, heat, and water to a CCUS project will be based on the definitions set out in the Act and the Regulations and determined by this Guide. The equipment described in this Section must meet the conditions of Section 2.2.1 to be Class 57 Property or Dual-use Property, as applicable. Dual-use equipment is described further in Section 1.6. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property or Dual-use Property could include, but are not limited to, the following:

- power, heat, or combined power and heat generation equipment that is to be used for producing the energy required to support a CCUS process:
  - conventional power generating equipment (e.g., steam turbine generators, expander generators) that is to be used to provide electrical power to a CCUS process, including any heat-producing equipment used for producing heat energy to drive the power generating equipment (e.g., steam boilers and duct burners used to produce steam to operate steam turbine generators);
  - clean energy generating equipment that is to be used for producing power for a CCUS process from renewable energy sources or fuels sourced from waste;
  - cogeneration equipment (e.g., gas turbine generators and reciprocating engine generator sets) that simultaneously produce power and heat that is to be used for the CCUS process;
  - heat recovery equipment (e.g., heat recovery steam generators, heat recovery boilers, heat exchangers, evaporators, and recuperators) that is to be used for recovering heat for use in a cogeneration system within a CCUS process;
  - backup power equipment (e.g., generator sets, uninterruptible power supply (UPS), battery backups) that is to be used for alternate power supply as needed for the CCUS process;
- heat distribution equipment that is used to deliver heat energy to support a CCUS process, including piping, valves, and mechanical fluid circulation equipment;
- power transmission or distribution equipment that is to be used for delivering electrical power to support a CCUS process:
  - electrical substation equipment (e.g., transmission lines, distribution lines, lighting arresters, bus bars) that is to be used to interconnect parts of an electric utility system within the CCUS process;
  - voltage/power transformation equipment (e.g., step-down and step-up transformers, voltage adaptors, voltage regulators, VAR compensator capacity upgrade) that is to be used for electricity stabilization and electricity transfer between circuits that have a change in voltage level;
  - wiring equipment (e.g., wires and cables, conduits, raceways and cable trays, industrial outlets, connectors) that is to be used for conducting electric current through the power system, including equipment to enclose electrical and/or electronic equipment and protect them against harsh environment (e.g., electrical enclosures);
  - protection and switchgear equipment (e.g., fuse boxes, breakers and breaker panels, transfer switch systems, disconnects, contactors, protection relays) that is to be used for control, protection, and isolation of electrical equipment or an electrical circuit from damage due to overload or short circuit in the power system;
- water use equipment that is to be used for collecting, recovering, treating, and/or recirculating water in support of a CCUS process:
  - feedwater and process water storage, feedwater and process water supply, and condensate treatment equipment (e.g., deaerators, water filters, pumps, holding tanks, piping, ducting, valves, flow and pressure meters, feedwater and utility lines) that is to

be used for storing feedwater, removing dissolved gases, moving the water and condensate required for steam production, cooling, and other water needs;

- tanks and vessels for handling materials, including mixing tanks, make-up tanks, and holding tanks for utility water and chemicals to purify and recover water for re-use, as well as equipment that is used to maintain the chemicals and fluids at the necessary storage conditions;
- mechanical fluid circulation equipment (e.g., blowers, fans, vacuum pumps, pumps) that is to be used for moving process streams, fluids, and solid streams; and
- any other property that is described in Class 57 or the definition of dual-use equipment in relation to a power and/or heat generation, power or heat distribution, power transmission, or water use process, including, but not limited to, ancillary equipment, monitoring and control equipment, and building or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

2.2.3 Typical Property Not Included in Class 57 or Dual-use Property

Property used in the power and/or heat generation process, power or heat distribution process, power transmission process, or water use process that is not Class 57 Property or Dual-use Property is ineligible for the CCUS tax credit. Examples of typical property not included in Class 57 and is not Dual-use Property include the following:

- heat and/or power generation equipment where the equipment uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project;
- oxygen production equipment as part of an oxy-fuel combustion heat and/or power generation process;
- fuel processing, conditioning, and upgrading equipment and property that is used to bring fuel to the conditions required for the heat and/or power production equipment, including monitoring and control equipment, building or other structures, and ancillary equipment
- power lines that sit on a shared transmission tower but are used solely to deliver electrical power as part of the electrical grid system to a process that is not part of the CCUS project; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note that this list is not exhaustive and is meant to provide general guidance on property used commonly in a power and/or heat generation process, power or heat distribution process, power transmission process, or water use process that is not Class 57 Property or Dual-Use Property.

2.2.4 Typical Capital Costs of Class 57 Property and Dual-Use Equipment

Typical costs of capital equipment used in constructing a power and/or heat generation process, power or heat distribution process, power transmission process, or water use process that is part of a CCUS project are provided in Table 2.2-1:

Table 2.2-1 Project cost table for power and/or heat generation, power or heat distribution, power transmission, or water use processes

Capital cost of Class 57 Property and Dual-use Equipment generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. **These costs may be attributed to the following technical applications as part of a power and/or heat generation, power or heat distribution, power transmission, or water use process, provided the property is Class 57 Property or Dual-use Property that is to be used for a CCUS process, such as, but not limited to, the Class 57 Property described in Section 2.2.2 or Section** 1.5.1**, or Dual-use Property described in Section** 1.6.1**:**	
1	Power and mechanical work generation equipment, including process maintenance equipment
2	Power transmission and distribution equipment, including ancillary phase synchronization, voltage regulation, frequency control, cooling, lubrication, fire protection, and acoustic protection equipment
3	Steam or heat generation equipment, including air supply and ash elimination equipment
4	Heat distribution equipment, including mechanical fluid circulation equipment
5	Process stream delivery, collection, recovery, treatment, and recirculation equipment, including impurity removal and heat recovery equipment
6	Boiler feedwater systems
7	Heat recovery equipment
8	Mechanical fluid circulation equipment
9	Electrical system equipment
10	Fuel supply system equipment
11	Liquid delivery and distribution system equipment
12	Utility cooling system equipment
13	Material handling and storage and distribution system equipment, including holding tanks, conditioning equipment, and fluid transfer equipment
14	Venting system equipment
15	Process waste management system equipment
16	Compressed utility air or nitrogen system equipment
17	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
18	Process safety equipment
19	Flow control and containment equipment
20	Buildings or other structures
21	Equipment for conversion of existing property into Class 57 Property or Dual-use Property
22	Equipment for refurbishment of existing Class 57 Property or Dual-use Property

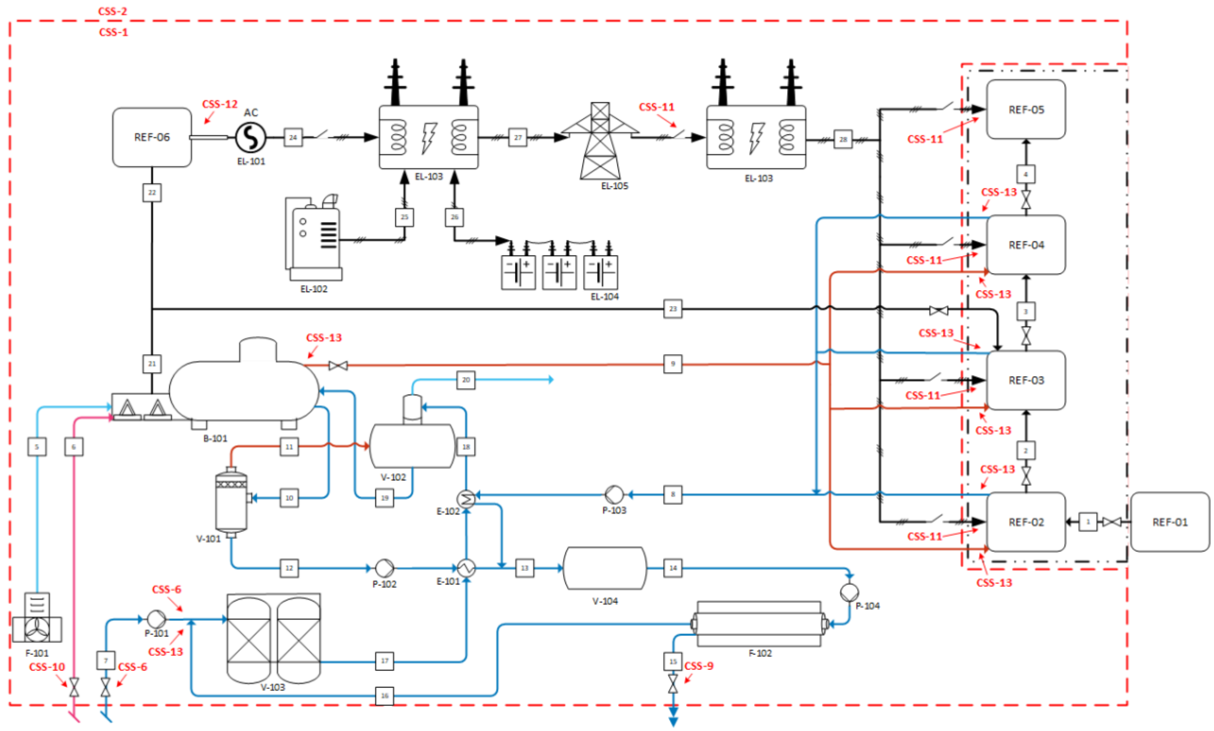
2.2.5 Schematic for Class 57 Property or Dual-Use Property in Heat and/or Power Generation, Power and Heat Distribution, Power Transmission, and Water Use Processes

Some typical elements of an integrated power and/or heat generation, power and heat distribution, power transmission, and water use process that supports a CCUS process are shown in Figure 2.2-1. Note that this process is shown as a reference block in other sections of this Guide. Process boundaries described here are for a typical power and/or heat production and water use process, using a schematic of a steam boiler and generic power production process as a representative example.

Note that the Class 57 Property and Dual-use Property is to be used for supporting the CCUS process — in this case, the provision of power and/or heat, distribution of heat and power, transmission of power, and delivery, collection, recovery, treatment, and/or recirculation of water. Although the property listed above is meant to represent typical elements of power and/or heat generation, power and heat distribution, power transmission, and water use processes that support a CCUS process, other Class 57 Property or Dual-use Property will be necessitated by the specific requirement of the CCUS process technology described in this section and other sections of this Guide.

Other equipment not listed may still be Class 57 Property or Dual-use Property. Ultimately, whether property presented in that guide is Class 57 Property or Dual-use Property will be based on the definitions set out in the Act and the Regulations and determined by this Guide. Dual-use equipment that fulfills the functions described in this section must be described in the definition of dual-use equipment to be eligible for the CCUS tax credit.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 2, please refer to Section 2.4. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
B-101	Boiler	Steam Boiler
E-101	Heat Exchanger	Blowdown Waste Heat Exchanger
E-102	Heat Exchanger	Condensate Return Waste HEX
EL-101	Electrical Infrastructure	Alternating Current Source
EL-102	Electrical Infrastructure	Back-Up Generator
EL-103	Electrical Infrastructure	Electrical Substation
EL-104	Electrical Infrastructure	Battery Storage / Uninterruptable Power Supply
EL-105	Electrical Infrastructure	Transmission Equipment
F-101	Air Supply	Fresh Air Supply and Filter
F-102	Water Filter	Reverse Osmosis Water Filter/ Blowdown-Condensate Purification
P-101	Pump	Raw Water Pump
P-102	Pump	Boiler Blowdown Pump
P-103	Pump	Condensate Return Pump
P-104	Pump	Reverse Osmosis Pump
V-101	Gas-Liquid Separator	Blowdown Knock-Out Drum
V-102	Deaerator	Boiler Feedwater Deaerator
V-103	Packed Vessel	Ion Exchange Demineralization Vessels
V-104	Vessel	Condensate/ Blowdown Storage

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Captured CO_2
4	Compressed and Purified CO_2
5	Combustion Air
6	Boiler Fuel Supply
7	Raw Water Supply
8	Steam Condensate Return
9	CCUS Steam Supply
10	Boiler Blowdown
11	Low Pressure Flash Steam
12	Boiler Blowdown Liquids
13	Condensate/Blowdown
14	RO Feed
15	Retentate Purge
16	RO Permeate Return
17	Demineralized Water
18	Heated Deaerator Feed
19	Boiler Feed Water
20	Deaerator Purge Gas
21	Boiler Flue Gas
22	Power Generation Flue Gas
23	CO_2 to Capture Plant
24	High Volatage Substation Supply
25	Back-Up Generator Supply
26	Battery/Uninterruptable Power Supply Tie-In
27	Transmission Line
28	Distribution Line

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Capture Process	Section 3
REF-04	CO_2 Compression and Purification	Section 2.3
REF-05	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8
REF-06	Power Generation	Section 2.2

Stream Legend

- CO_2
- Water
- Steam
- Air
- Fuel
- Electricity

Class 57 Property or Dual-use Property for a Power and/or Heat Generation, Power and Heat Distribution, Power Transmission and Water Use Process

Other Class 57 Property or Class 58 Property

Figure 2.2-1: An example of a power and heat generation, power and heat distribution, power transmission, and water use process supporting a CCUS process.

Figure Text Description: Diagram illustrating the boundaries of a power and/or heat and water process with equipment supporting a CCUS process which includes equipment, such as boilers, heat exchangers and pumps, needed to provide steam or water to a CO_2 pre-treatment process, CO_2 capture process or CO_2 purification and compression process, and which includes equipment, such as generators, substations and other electrical infrastructure, needed to provide power to a CO_2 pre-treatment process, CO_2 capture process, CO_2 purification and compression process, or CO_2 transportation and CO_2 storage/use process. Boundaries for secondary systems within this process include CSS-6 and CSS-9 for water, CSS-13 for heat distribution, CSS-11 for power distribution, CSS-12 for power transmission, and CSS-10 for fuel. For notes on process boundaries for this schematic and all other schematics in Section 2, please refer to Section 2.4, but not all notes apply to each schematic.

2.3 CO_2 Purification and Compression

2.3.1 CO_2 Purification and Compression Processes

CO_2 purification and compression processes use equipment to prepare a stream of captured carbon for the purpose of bringing it to specifications required for the carbon transportation process.

Property that is a part of a CO_2 purification and compression process (described in Class 57 subparagraph (a)(ii)) could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
  - the property is to be used for preparing or compressing captured carbon for transportation and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
  - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

2.3.2 Pertinent Class 57 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process where CO_2 purification and compression is used for a CCUS process will be based on the definitions set out in the Act and the Regulations and determined by this Guide. The equipment described in this Section must meet the conditions of Section 2.3.1 to be Class 57 Property. This Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, the following:

- mechanical pressurization and circulation equipment (e.g., compressors, pumps, blowers, fans) that is to be used for pressurizing CO_2 to conditions required for transport;

- cooling and heat recovery equipment (e.g., intercoolers, condensers, cooling water heat exchangers, direct contact coolers) that is to be used for reducing or controlling process stream temperature during compression to condition the CO_2 for further processing or for transportation;
- impurity separation equipment (e.g., knockout drums, scrubbers, filters, dryers, and other separators) that is to be used for separating liquids, volatiles, and other impurities from the CO_2 stream and to dry and prepare the CO_2 for transportation;
- dehydration equipment (e.g., triethylene glycol or similar water absorbent/solvent equipment, refrigeration equipment, auto-refrigeration equipment) that is to be used for removing water from a CO_2 stream within the CCUS process, including:
    - water separation equipment (e.g., absorption columns, low temperature separators, membranes) that is to be used for separating water from the CO_2 stream, including equipment for fluid reflux (e.g., reflux drums, fluid circulation equipment) when necessary;
    - water stripping equipment (e.g., regeneration columns, separators) that is to be used for separating water from the water absorbent/solvent, including equipment for fluid reflux (e.g., reflux drums and fluid circulation equipment) and equipment for reboiling (e.g., reboilers, condensate pots);
    - heat recovery equipment (e.g., rich/lean water absorbent/solvent cross heat exchangers) that is to be used for controlling process stream temperature to facilitate absorption and stripping of water from the water absorbent/solvent;
    - cooling equipment (e.g., intercoolers, condensers, cooling water heat exchangers) that is to be used for reducing process stream temperature to facilitate absorption and stripping of water from the water absorbent/solvent;
    - lean water absorbent/solvent recovery and collection equipment (e.g., filters, flash drums, drain drums) that is to be used for collecting and recovering the water absorbent/solvent for re-use within the dehydration equipment or disposal; and
    - mechanical fluid circulation equipment (e.g., expanders, Joule-Thompson valves, compressors, pumps) that is to be used for moving process streams and fluids through the dehydration equipment;
- liquefaction equipment (e.g., refrigeration cycle equipment) that is to be used for liquefying CO_2 for temporary storage and transportation in a liquid phase within the CCUS process, including:
    - cooling equipment (e.g., pre-cooling and cooling water heat exchangers, condensers, chillers, liquefiers) that is to be used for reducing the temperature of CO_2 and liquefying it;
    - refrigeration cycle equipment (e.g., condensers, evaporators, heat exchangers, expanders, turbines, valves, pumps) that is to be used for reducing the temperature of the refrigerant in order to exchange heat with the CO_2 stream during liquefaction;
    - water and purge gas separation equipment (e.g., distillation columns, flash drums, and similar separators) that is to be used for separating water and gases from the liquefied CO_2 stream; and

  - mechanical fluid circulation equipment (e.g., expanders, Joule-Thompson valves, compressors, pumps) that is to be used for moving process streams and fluids through the dehydration equipment;

- tanks for handling materials that are to be used for the CCUS process, including surge tanks, drain tanks, and holding tanks for water absorbent/solvent, refrigerants, nitrogen, and other chemicals, as well as equipment that is used to maintain the chemicals and fluids at the necessary storage conditions; and
- any other property that is described in Class 57 in relation to a CO_2 purification and compression process, including, but not limited to, ancillary equipment, monitoring and control equipment, and building or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

Certain property that supports a CO_2 purification and compression process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, may also be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates heat energy in support of a qualified CCUS project;
- generation equipment that generates electrical energy in support of a qualified CCUS project;
- generation equipment that generates a combination of electrical and heat energy in support of a qualified CCUS project;
- distribution equipment that distributes heat energy in support of a qualified CCUS project;
- distribution equipment that distributes electrical energy in support of a qualified CCUS project;
- transmission equipment that transmits electrical energy in support of a qualified CCUS project; and
- water use equipment that delivers, collects, recovers, treats, or recirculates water, or a combination of any of those activities, in support of a qualified CCUS project.

2.3.3 Typical Property Not Included in Class 57

Property used in the CO_2 purification and compression process that is not Class 57 Property is ineligible for the CCUS tax credit. Examples of typical property not included in Class 57 include the following:

- purge gas treatment equipment (e.g., wash water absorption vessels, fluid circulation equipment, cooling equipment, pressure swing adsorption equipment, and ancillary equipment) that is used for treating purge gas for use in a non-CCUS process (e.g., hydrogen production process, industrial process);
- equipment that is used in purification and compression of hydrogen, natural gas, or acid gas other than CO_2;
- fuel processing, conditioning, and upgrading equipment and property, including monitoring and control equipment, building or other structures, and ancillary equipment; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note, this list is not exhaustive and is meant to provide general guidance on typical property used in a CO_2 purification and compression process that is not Class 57 Property.

2.3.4 Typical Capital Costs Included in Class 57

Typical capital costs when constructing a CO_2 purification and compression process that is part of a CCUS project would include the costs provided in Table 2.3-1:

Table 2.3-1 Project cost table for CO_2 purification and compression processes

Capital cost of Class 57 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. **These costs may be attributed to the following technical applications as part of a CO_2 purification and compression process, provided the property is Class 57 Property such as, but not limited to, the Class 57 Property described in Section 2.3.2 or Section** 1.5.1**:**	
1	CO_2 purification and pressurization equipment
2	CO_2 dehydration equipment
3	CO_2 liquefaction equipment, including temporary storage equipment
4	Mechanical fluid circulation equipment
5	Heat generation equipment – see Section 2.2 for details
6	Heat distribution equipment – see Section 2.2 for details
7	Electricity generation equipment – see Section 2.2 for details
8	Electricity distribution equipment – see Section 2.2 for details
9	Electricity transmission equipment – see Section 2.2 for details
10	Process water stream delivery, collection, recovery, treatment, and recirculation equipment – see Section 2.2 for details
11	Electrical system equipment
12	Fuel supply system equipment
13	Liquid delivery and distribution equipment
14	Utility cooling system equipment
15	Material handling and storage and distribution system equipment, including holding tanks, conditioning equipment, and fluid transfer equipment
16	Venting system equipment
17	Process waste management system equipment
18	Compressed utility air or nitrogen system equipment
19	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
20	Process safety equipment
21	Flow control and containment equipment
22	On-site piping from the CO_2 purification and compression process to the main carbon transportation system
23	Buildings or other structures
24	Equipment for conversion of existing property into Class 57 Property
25	Equipment for refurbishment of existing Class 57 Property

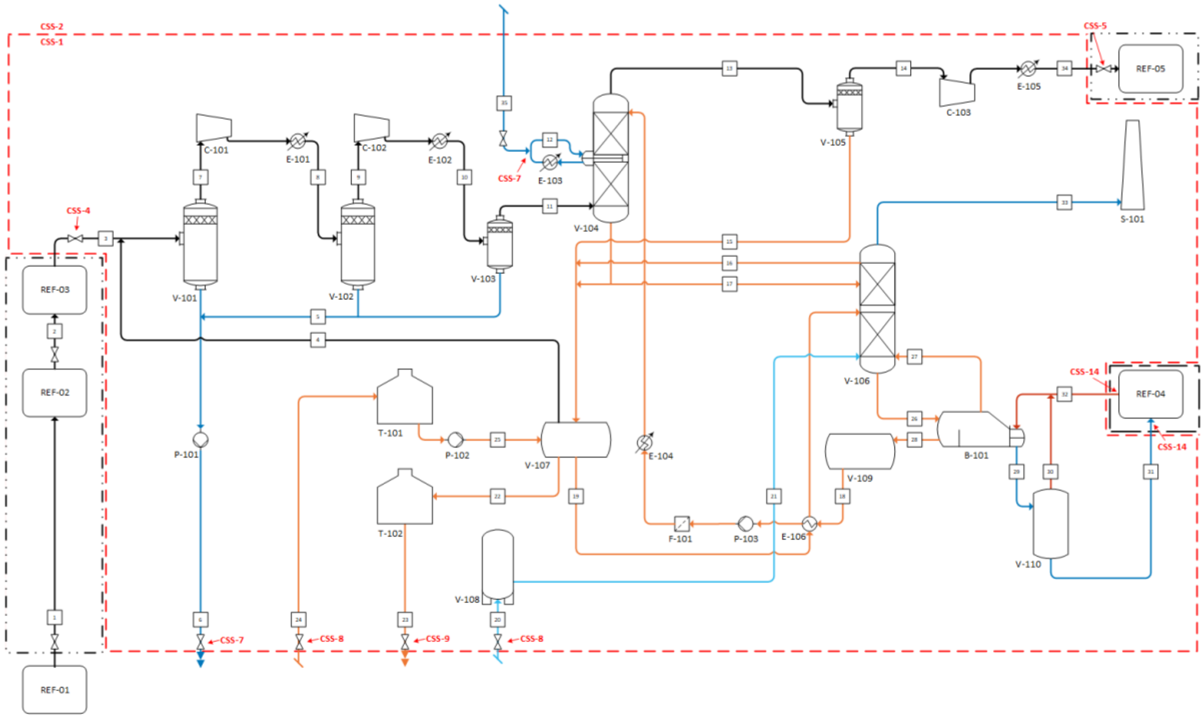
2.3.5 Schematics for Class 57 Property in CO_2 Purification and Compression Processes

Some typical elements of a CCUS process that can be used to compress and purify CO_2 are shown in Figure 2.3-1 and Figure 2.3-2. Process boundaries defined here are for typical CO_2 purification and compression processes, using schematics of a CO_2 purification and compression process with multi-stage compression and triethylene glycol dehydration system and with a liquefaction system as representative examples.

However, note that the specific property that is used in a raw CO_2 purification and compression process may depend on the CO_2 purity and pressure required by the type of carbon transportation technology used in the CCUS process. Ultimately, whether particular property is Class 57 Property will depend on its function within the CCUS process.

Other equipment not listed may still be Class 57 Property and can include adsorption and regeneration towers; gas heaters, coolers, and heat exchangers; membranes and filters; condensing expanders and Joule-Thompson valves; stabilizer vessels; and three-phase separators. Absorbents/ solvents and adsorbents that may be used in dehydration equipment and could necessitate different equipment requirements for CO_2 purification and compression include chemical solvents such as triethylene glycol and other glycol solvents, as well as solid desiccants such as calcium, potassium, and lithium chlorides.

<u>NOTE: For keys to the process boundary notes on these schematics, as well as the other schematics in Section 2, please refer to Section 2.4. Note that not all notes apply to each schematic.</u>



Equipment Identifier	Equipment Type	Equipment Description
B-101	Boiler	Water Absorbent Regenerator Reboiler
C-101	Compressor	CO_2 Compressor 1
C-102	Compressor	CO_2 Compressor 2
C-103	Compressor	CO_2 Compressor 3
E-101	Heat Exchanger	Cooling Water HEX 1
E-102	Heat Exchanger	Cooling Water HEX 2
E-103	Heat Exchanger	Intercooler Cooling Water HEX
E-104	Heat Exchanger	Cooling Water HEX 3
E-105	Heat Exchanger	Cooling Water HEX 4
E-106	Heat Exchanger	Water Absorbent Rich-Lean Cross HEX
F-101	Filter	Particulate Filter
P-101	Pump	Knockout Condensate Pump
P-102	Pump	Fresh Water Absorbent Pump
P-103	Pump	Lean Water Absorbent Circulation Pump
S-101	Stack	Water-Nitrogen Emissions Stack
T-101	Chemical Tank	Water Absorbent Make-up Storage Tank
T-102	Chemical Tank	Water Absorbent Drain Tank
V-101	Gas-Liquid Separator	CO_2-Water Knockout Drum 1
V-102	Gas-Liquid Separator	CO_2-Water Knockout Drum 2
V-103	Gas-Liquid Separator	CO_2-Water Knockout Drum 3
V-104	Packed Column	Water Absorbent Absorber
V-105	Gas-Liquid Separator	CO_2 - Water Absorbent Knockout Drum
V-106	Packed Column	Water Absorbent Regenerator
V-107	Gas-Liquid Separator	Rich Water Absorbent Flash Drum
V-108	Pressure Vessel	Nitrogen Storage Tank
V-109	Vessel	Lean Water Absorbent Surge Tank
V-110	Gas-Liquid Separator	Steam Condensate Flash Drum

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Captured CO_2
4	Recycled CO_2
5	Knockout Condensate Collection
6	Condensate to Wastewater
7	CO_2 Compressor 1 Feed
8	Knockout Drum 2 Feed
9	CO_2 Compressor 2 Feed
10	Knockout Drum 3 Feed
11	CO_2 Absorber Feed
12	Absorber Intercooler Water
13	Dry CO_2
14	Dry Purified CO_2
15	Water Absorbent Knockout Drum Condensate
16	Lean WA Recirculation
17	Rich Water Absorbent
18	Absorber Lean Water Absorbent Inlet
19	Regenerator Rich Water Absorbent Inlet
20	Nitrogen Tank Fill Line
21	Absorber Nitrogen Sweep Gas
22	Water Absorbent Drain Line
23	Water Absorbent Drain Disposal
24	Make-up Water Absorbent Tank Fill Line
25	Make-up Water Absorbent Injection Line
26	Regenerator Bottoms to Reboiler
27	Reboiler Return
28	Lean Water Absorbent
29	Reboiler Steam Condensate
30	Flash Steam Return
31	Steam Condensate Return
32	Reboiler Steam Input
33	Water-Nitrogen Emission
34	Compressed and Purified CO_2
35	Feed Water

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Capture Process	Section 3
REF-04	Power and/or Heat and Water	Section 2.2
REF-05	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

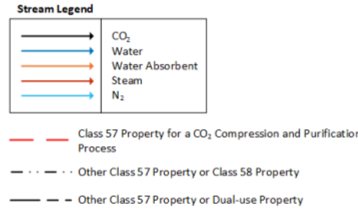
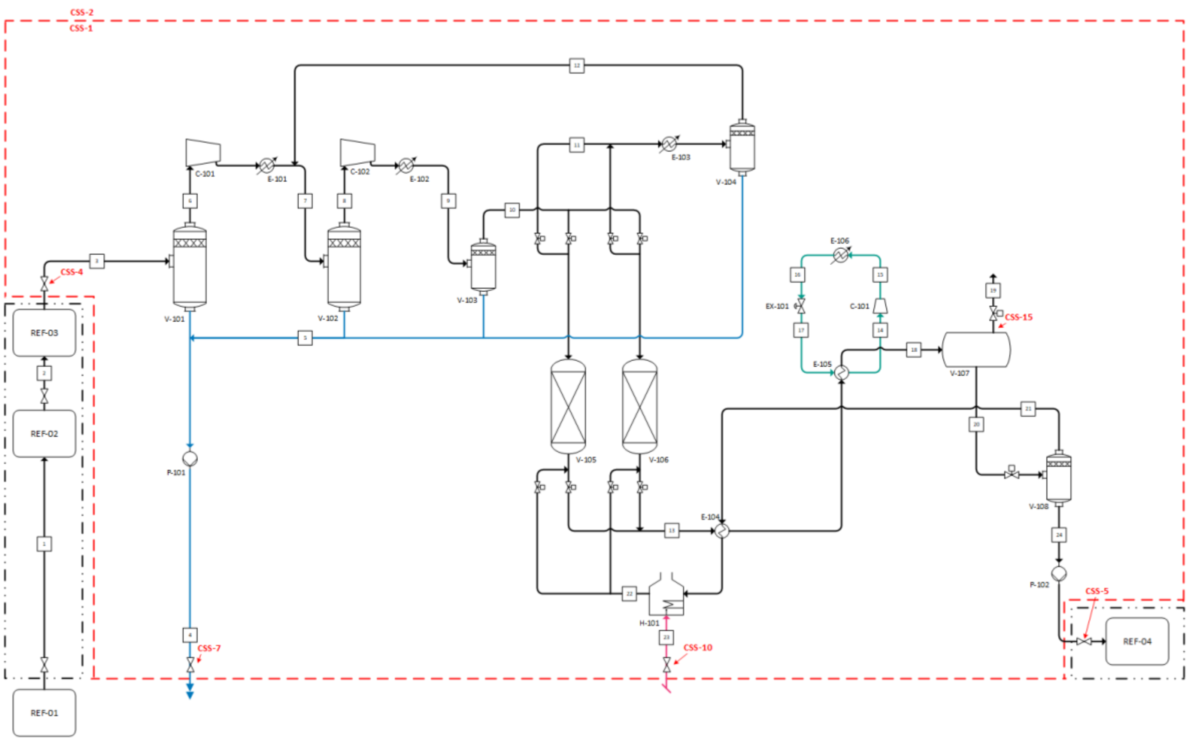


Figure 2.3-1: An example of a CO_2 purification and compression process with multi-stage compression and triethylene glycol dehydration.

Figure Text Description: Diagram illustrating the boundaries of a CO_2 purification and compression process with multi-stage compression. The boundary begins after a CO_2 capture process at CSS-4 and includes equipment such as compressors, heat exchangers, knock outs, pumps, and separators, ending at CSS-5 where a CO_2 transportation and CO_2 storage/use process begins. Boundaries for secondary streams within this process include CSS-7 for water effluent, CSS-8 for water absorbent stream, CSS-8 for nitrogen streams, and CSS-14 for steam. For notes on process boundaries for this schematic and all other schematics in Section 2, please refer to Section 2.4, but not all notes apply to each schematic.

NOTE: For keys to the process boundary notes on these schematics, as well as the other schematics in Section 2, please refer to Section 2.4. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	CO_2 Compressor 1
C-102	Compressor	CO_2 Compressor 2
C-103	Compressor	Refrigerant Compressor
E-101	Heat Exchanger	Cooling Water HEX 1
E-102	Heat Exchanger	Cooling Water HEX 2
E-103	Heat Exchanger	Regenerated Gas HEX
E-104	Heat Exchanger	CO_2 Cross HEX
E-105	Heat Exchanger	CO_2-Refrigerant Liquefaction HEX
E-106	Heat Exchanger	Refrigerant Condenser
EX-101	Expander	Refrigerant Expansion Valve
H-101	Heater	Gas Furnace
P-101	Pump	Knockout Condensate Pump
P-102	Pump	Cryogenic Liquid CO_2 Pump
V-101	Gas-Liquid Separator	CO_2-Water Knockout Drum 1
V-102	Gas-Liquid Separator	CO_2-Water Knockout Drum 2
V-103	Gas-Liquid Separator	CO_2-Water Knockout Drum 3
V-104	Gas-Liquid Separator	Regenerated Gas Knock Out Drum
V-105	Packed Bed	CO_2 Dryer/Adsorption Vessel 1
V-106	Packed Bed	CO_2 Dryer/Adsorption Vessel 2
V-107	Gas-Liquid Separator	Liquid CO_2 Separator
V-108	Gas-Liquid Separator	Liquid CO_2 Flash Drum

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Captured CO_2
4	Condensate to Wastewater
5	Knockout Condensate Collection
6	CO_2 Compressor 1 Feed
7	Knockout Drum 2 Feed
8	CO_2 Compressor 2 Feed
9	Knockout Drum 3 Feed
10	CO_2 Adsorber Feed
11	Regenerated Gas
12	Regenerated Gas Recycle
13	Purified CO_2 Gas
14	Warm Refrigerant
15	Compressed Refrigerant
16	Condensed Refrigerant
17	Cooled Refrigerant
18	Liquefied CO_2 1
19	Purge Gas
20	Liquefied CO_2 2
21	Recycled CO_2
22	Pre-Heated Recycled CO_2
23	Fuel Feed
24	Purified Cryogenic Liquid CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Capture Process	Section 3
REF-04	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

CO_2
Water
Fuel
Refrigerant

Class 57 Property for a Liquefaction CO_2 Compression and Purification Process

Other Class 57 Property or Class 58 Property

Figure 2.3-2: An example of a CO_2 purification and compression process with liquefaction.

Figure Text Description: Diagram illustrating the boundaries of a CO_2 purification and compression process with liquefaction. The boundary begins after a CO_2 capture process at CSS-4 includes equipment such as compressors, heat exchangers, knock outs, pumps, and separators, but ending at CSS-5 where a CO_2 transportation and CO_2 storage/use process begins. Boundaries for secondary streams within this process include CSS-7 for water effluent and CSS-10 for fuels needed for heaters such as gas furnaces. For notes on process boundaries for this schematic and all other schematics in Section 2, please refer to Section 2.4, but not all notes apply to each schematic.

2.4 Process Boundary Notes on Schematics of Pre-Treatment, Purification and Compression, and Power and/or Heat and Water Processes

A key to the process boundary notes on the schematics is provided here and includes the definition of process boundaries for typical raw CO_2 pre-treatment, CO_2 purification and compression, and power and/or heat and water processes.

CSS-1 For descriptions of Class 57 Property or Dual-use Property included within this process boundary, see Section 2.1.2, 2.2.2, and 2.3.2 of this Guide.

CSS-2 For descriptions of ineligible property that may be contained within this process boundary, see Section 2.1.3, 2.2.3, and 2.3.3 of this Guide.

CSS-3 The CO_2 supply piping that is used by a raw CO_2 pre-treatment process is described in Class 57 subparagraph (a)(i) and the process boundary begins at, and includes, the first control valve that is used solely by property described in Class 57 subparagraph (a)(i). Where there is no control valve as described above, the process boundary for a raw CO_2 pre-treatment process is the point where the piping for the CO_2 supply system physically connects to the property described in Class 57 subparagraph (a)(i).

CSS-4 The CO_2 supply piping that is used by a CO_2 purification and compression process is described in Class 57 subparagraph (a)(ii) and the process boundary begins at, and includes, the first control valve that is used solely for property described in Class 57 subparagraph (a)(ii). If a CO_2 purification and compression process is immediately downstream of a raw CO_2 pre-treatment, carbon capture, or direct air capture process, the CO_2 purification and compression process boundary would immediately follow property described in Class 57 subparagraph (a)(i) and begin at the point indicated by the terminal boundary for a raw CO_2 pre-treatment process described in CSS-5, CS-4, or DACS-5, respectively. Where there is no control valve as described above, the process boundary does not include the pipeline supplying CO_2 and begins at the point where the piping for the CO_2 supply system physically connects to the property described in Class 57 subparagraph (a)(ii).

CSS-5 The process boundary of the CO_2 piping system that is used by a raw CO_2 pre-treatment or CO_2 purification and compression processes begins at the point indicated by CSS-3 or CSS-4 and ends at the first control valve along the piping after raw CO_2 pre-treatment property described in Class 57 subparagraph (a)(i) or property described in Class 57 subparagraph (a)(ii), respectively, excluding the control valve itself.

CSS-6 The water delivery, collection, recovery, treatment, and/or recirculation system, as part of a water use process used by a power and/or heat and water process, is described in Class 57 subparagraph (a)(v) and generally includes piping and components that are used to supply feedwater that solely supports a qualified CCUS project. The equivalent dual-use equipment described in subparagraph (a)(ii) in the definition of dual-use equipment includes piping and components that are used to supply feedwater. The water use process boundary related to the water delivery system begins at, and includes, the first control valve along the piping system that is used by Class 57 Property, Class 58 Property, or Dual-use Property to support a qualified CCUS project and includes all piping downstream, up to the point where the piping for the water use process physically connects to Class 57 Property, Class 58 Property, or Dual-use Property that is not part of the water use process. Often, the water use process will physically connect to heat production property described in Class 57 subparagraph (a)(iii) or subparagraph (a)(i) in the definition of dual-use equipment. Other property that is part of the water delivery, collection, recovery, treatment, and/or recirculation system may not be shown but may still be water use process equipment if it is described in Class 57 subparagraph (a)(v) or subparagraph (a)(ii) in the definition of dual-use equipment.

CSS-7 The water delivery, collection, recovery, treatment, and/or recirculation system, as part of a water use process that supports a raw CO_2 pre-treatment or CO_2 purification and compression process, is described in Class 57 subparagraph (a)(v) or subparagraph (a)(ii) in the definition of dual-use equipment and is not within the raw CO_2 pre-treatment or CO_2 purification and compression process boundary. The raw CO_2 pre-treatment or CO_2 purification and compression process boundary related to the water use system begins at the point where the piping for the water use process physically connects to the property described in Class 57 subparagraph (a)(i) or (a)(ii).

CSS-8 The process material storage and handling and distribution system, and the liquid delivery and distribution system, used by a raw CO_2 pre-treatment or CO_2 purification and compression process is described in Class 57 paragraph (d) and includes piping and components that are used solely to carry solid, liquid, or gaseous materials from unloading areas to Class 57 Property. The raw CO_2 pre-treatment or CO_2 purification and compression process boundary related to the material storage and handling and distribution system, and the liquid delivery and distribution system, begins at, and includes, the fitting that connects the piping to the delivery vessel or pipeline and includes all piping downstream, up to the point where the piping for the process material storage and handling and distribution system, or the liquid delivery and distribution system, physically connects to the property described in Class 57 subparagraph (a)(i) or (a)(ii). Where the material or liquid is not used solely by Class 57 Property, the process boundary related to the material storage and handling and distribution system, and liquid delivery and distribution system, begins at the point where the piping physically connects to the property described in Class 57 subparagraph (a)(i) or (a)(ii).

CSS-9 The process waste management system used by a raw CO_2 pre-treatment, power and/or heat and water, or CO_2 purification and compression process is described in Class 57 paragraph (d) and includes piping and components that are used solely to deliver waste streams coming from Class 57 Property or Dual-use Property to loading areas. The raw CO_2 pre-treatment, power and/or heat and water, or CO_2 purification and compression process boundary related to the process waste management system begins at the point where the piping for the process waste management system physically connects to the property described in Class 57 subparagraph (a)(i), (a)(ii), (a)(iii), or (a)(v) or subparagraph (a)(i) or (a)(ii) in the definition of dual-use equipment and includes all piping downstream, up to, and including, the last control valve before the point where the waste is removed from the plant boundary. If the whole piping system is used solely by Class 57 Property or Dual-use Property, all piping up to, and including, the fitting used to connect the system with a disposal vessel or pipeline is included in the process boundary.

CSS-10 The fuel supply system used by a power and/or heat and water process is described in Class 57 paragraph (d) and paragraph (b) in the definition of dual-use equipment and includes piping and components used solely to deliver fuel to Class 57 Property or Dual-use Property. The power and/or heat and water process boundary related to the fuel supply system begins at, and includes, the first control valve along the piping that is used solely by Class 57 Property or Dual-use Property and includes all piping up to the point where the piping physically connects to the property described in Class 57 subparagraph (a)(iii) or (a)(v), or subparagraph (a)(i) or (a)(ii) in the definition of dual-use equipment.

CSS-11 The power distribution system used by a power and/or heat and water process is described in Class 57 subparagraph (a)(iii) and generally includes the power lines and components that are used to distribute electrical energy that directly and solely supports a qualified CCUS project. The equivalent dual-use equipment described in subparagraph (a)(iv) in the definition of dual-use equipment includes the power lines and components that are used to distribute electrical energy. The power and/or heat and water process boundary related to the power distribution system begins at, and includes, the first piece of equipment that lies within the fence of an electrical substation for stepping-down voltage to distribution voltages of 69 kV or lower along the power distribution system that is used by the Class 57 Property, Class 58 Property, or Dual-use Property to support a qualified CCUS project and includes all power lines downstream, up to the point where the power lines for the power distribution system physically connect to Class 57 Property, Class 58 Property, or Dual-use Property that is not part of the electricity transmission, distribution, or generation process.. Often, the power distribution system will physically connect to an ancillary electrical system described in Class 57 subparagraph (d)(i) or subparagraph (b)(i) in the definition of dual-use equipment. If the power distribution substation is not used by the Class 57 Property, Class 58 property, or Dual-use Property to support a qualified CCUS project, the power and/or heat and water process boundary related to the power distribution system begins at, and includes, the first isolation switch along the power distribution system that is used by the Class 57 Property, Class 58 Property, or Dual-use Property to support a qualified CCUS project. Where there is no isolation switch as described above, the power distribution system is not within the boundary of the power and/or heat and water process.

CSS-12 The power transmission system used by a power and/or heat and water process is described in Class 57 subparagraph (a)(iv) and generally includes the power lines and components that are used to directly and solely transmit electrical energy from property described in Class 57 subparagraph (a)(iii) to a qualified CCUS project. The equivalent dual-use equipment described in subparagraph (a)(iii) in the definition of dual-use equipment includes the power lines and components that are used to directly and primarily transmit electrical energy from property described in subparagraph (a)(i) in the definition of dual-use equipment to a qualified CCUS project or a qualified clean hydrogen project. The power and/or heat and water process boundary related to the power transmission system begins at, and includes, the first piece of equipment that lies within the fence of an electrical substation for stepping-up voltage to transmission voltages of greater than 69 kV and includes all power lines downstream, up to the point where the power lines for the power transmission system physically connects to the power distribution property described in Class 57 subparagraph (a)(iii), or subparagraph (a)(iv) in the definition of dual-use equipment. Typically, this would be located at the point where the transmission power lines physically connect to the first piece of equipment that lies within the fence of an electrical substation for stepping-down voltage to distribution voltages of 69 kV or lower. If the power transmission system is not physically connected to the electricity generation property described in Class 57 subparagraph (a)(iii) or subparagraph (a)(i) in the definition of dual-use equipment and does not directly transmit electrical energy to a qualified CCUS project or a qualified clean hydrogen project, the power transmission system is not within the boundary of the power and/or heat and water process.

CSS-13 The heat distribution system, as part of a power and/or heat and water process, is described in Class 57 subparagraph (a)(iii) and generally includes piping and components that are used to distribute heat energy that directly and solely supports a qualified CCUS project. The equivalent dual-use equipment described in subparagraph (a)(iv) in the definition of dual-use equipment includes piping and components that are used to distribute heat energy. The power and/or heat and water process boundary related to the heat distribution system begins at the point where the piping for the heat distribution system physically connects to the heat production equipment described in Class 57 subparagraph (a)(iii) or subparagraph (a)(i) in the definition of dual-use equipment and includes all piping downstream, up to the point where the piping for the heat distribution system physically reconnects to heat production equipment described in Class 57 subparagraph (a)(iii) or subparagraph (a)(i) in the definition of dual-use equipment. If the heat distribution system is not physically connected to property described in Class 57 subparagraph (a)(iii) or subparagraph (a)(i) in the definition of dual-use equipment, the power and/or heat and water process boundary related to the heat distribution system begins at, and includes, the first control valve along the piping system that is used by Class 57 Property, Class 58 Property, or Dual-use Property to support a qualified CCUS project. Where there is no control valve as described above, the heat distribution system is not within the boundary of the power and/or heat and water process.

CSS-14 The heat distribution system that supports a CO_2 purification and compression process is described in Class 57 subparagraph (a)(iii) or subparagraph (a)(iv) in the definition of dual-use equipment and is not within the CO_2 purification and compression process boundary. The CO_2 purification and compression process boundary related to the heat distribution process begins at the point where the piping for the heat distribution process physically connects to the property described in Class 57 subparagraph (a)(ii).

CSS-15 The process venting system used by a CO_2 purification and compression process is described in Class 57 paragraph (d) and includes piping and components that are used solely to release gases from Class 57 Property. The CO_2 purification and compression process boundary related to the process venting system begins at the point where the piping for the process venting system physically connects to the property described in Class 57 subparagraph (a)(ii) and includes all piping and venting equipment.

2.4.1 Class 57 Property or Dual-Use Property Not Shown on the Schematic of Pre-Treatment, Compression and Purification, and Power and/or Heat and Water Processes

There is other property and systems ancillary to raw CO_2 pre-treatment, CO_2 purification and compression, and power and/or heat and water processes that are not explicitly shown in the schematic but are still part of the CCUS process***.***

- The cooling system used by a raw CO_2 pre-treatment, power and/or heat and water, or CO_2 purification and compression process is described in Class 57 paragraph (d) and includes piping and components that are used solely to deliver cooling fluid (e.g., cooling water, air, glycol) to and from the Class 57 Property or Dual-use Property. The raw CO_2 pre-treatment, power and/or heat and water, or CO_2 purification and compression process boundary related to the cooling system begins at, and includes, the first control valve along the piping or ducting system that is used solely by the Class 57 Property or Dual-use Property and includes all piping or ducting downstream, up to and including the last control valve along the piping or ducting system that is used solely by the Class 57 Property or Dual-use Property. These points are located before and after the property described in Class 57 subparagraph (a)(i), (a)(ii), (a)(iii), or (a)(v), or subparagraph (a)(i) or (a)(ii) in the definition of dual-use equipment. If the whole cooling system is used solely by Class 57 Property or Dual-use Property, all piping and components are within the process boundaries of these processes. Otherwise, the raw CO_2 pre-treatment, power and/or heat and water use, or CO_2 purification and compression process boundary related to the cooling systems is the point where the piping for the cooling system physically connects to the property described in Class 57 subparagraph (a)(i), (a)(ii), (a)(iii), or (a)(v), or subparagraph (a)(i) or (a)(ii) in the definition of dual-use equipment.
- The utility air or nitrogen distribution system used by a raw CO_2 pre-treatment, power and/or heat and water, or CO_2 purification and compression process is described in Class 57 paragraph (d) and includes piping and components that are used solely to supply utility air or nitrogen for the operation of equipment (e.g., pneumatic) and control systems (e.g., actuators) that is Class 57 Property or Dual-use Property. The raw CO_2 pre-treatment, power and/or heat and water, or CO_2 purification and compression process boundary related to the utility air or nitrogen distribution system begins at, and includes, the first control valve along the piping system that is used solely by the Class 57 Property or Dual-use Property and includes all piping downstream, up to the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 57 subparagraph (a)(i), (a)(ii), (a)(iii), or (a)(v), or subparagraph (a)(i) or (a)(ii) in the definition of dual-use equipment. Otherwise, the raw CO_2 pre-treatment, power and/or heat and water, or CO_2 purification and compression process boundary related to the utility air or nitrogen distribution system is the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 57 subparagraph (a)(i), (a)(ii), (a)(iii), or (a)(v), or subparagraph (a)(i) or (a)(ii) in the definition of dual-use equipment.

- The electrical system used by a raw CO_2 pre-treatment, power and/or heat and water, or CO_2 purification and compression process is described in Class 57 paragraph (d) and includes wiring and components that are used solely to supply electrical energy for the operation of equipment that is Class 57 Property or Dual-use Property. The raw CO_2 pre-treatment, power and/or heat and water, or CO_2 purification and compression process boundary related to the electrical system begins at, and includes, the first isolation switch along the wiring system that is used solely by the Class 57 Property or Dual-use Property and includes all wiring downstream, up to the point where the wiring for the electrical system physically connects to the property described in Class 57 subparagraph (a)(i), (a)(ii), (a)(iii), or (a)(v), or subparagraph (a)(i) or (a)(ii) in the definition of dual-use equipment. Otherwise, the raw CO_2 pre-treatment, power and/or heat and water, or CO_2 purification and compression process boundary related to the electrical system is the point where the wiring for the electrical system physically connects to the property described in Class 57 subparagraph (a)(i), (a)(ii), (a)(iii), or (a)(v), or subparagraph (a)(i) or (a)(ii) in the definition of dual-use equipment.
- The power distribution system that supports a raw CO_2 pre-treatment or CO_2 purification and compression process is described in Class 57 subparagraph (a)(iii) or subparagraph (a)(iv) in the definition of dual-use equipment and is not within the raw CO_2 pre-treatment or CO_2 purification and compression process boundary. The raw CO_2 pre-treatment or CO_2 purification and compression process boundary related to the power distribution system begins at the point where the power lines for the power distribution system physically connect to the property described in Class 57 subparagraph (a)(i) or (a)(ii).

3 Capture Processes

3.1 Absorbent/Solvent-Based Carbon Capture

3.1.1 Absorbent/Solvent-Based Carbon Capture Processes

Absorbent/solvent-based carbon capture processes use equipment featuring chemical or physical absorption technology to separate CO_2 for the purpose of capturing it.

Property that is a part of an absorbent/solvent-based carbon capture process, which is a subset of technology within carbon capture processes (described in Class 57 clause (a)(i)(A)), could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
  - the property is to be used solely for capturing carbon dioxide that would otherwise be released into the atmosphere, is not oxygen production equipment, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
  - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

3.1.2 Pertinent Class 57 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process where absorbent/solvent-based carbon capture is the primary technology will be based on the definitions set out in the Act and the Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 3.1.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, the following:

- CO_2 absorption equipment (e.g., packed, plated, and tray absorption columns, carbonator reactors) that is to be used for separating CO_2 from other gases in the incoming raw CO_2 stream, including equipment for fluid reflux (e.g., reflux drums and fluid circulation equipment) when necessary, and equipment for treating incoming feedwater that is to be used as wash water (e.g., filters, ion exchange vessels, reverse osmosis systems);

- CO_2 stripping equipment (e.g., packed, plated, and tray regeneration columns, calciner reactors, lean absorbent/solvent flash vessels) that is to be used for separating CO_2 from the absorbent/solvent, including equipment for fluid reflux (e.g., reflux drums and fluid circulation equipment) and equipment for reboiling (e.g., reboilers, condensate pots);
- heat recovery equipment (e.g., rich/lean absorbent/solvent cross heat exchangers, heat pumps) that is to be used for controlling process stream temperature to facilitate absorption and stripping of CO_2 from the absorbent/solvent;
- cooling equipment (e.g., condensing economizers, intercoolers, condensers, cooling heat exchangers) that is to be used for reducing process stream temperature to facilitate absorption and stripping of CO_2 from the absorbent/solvent;
- lean absorbent/solvent recovery and collection equipment (e.g., absorbent/solvent reclaimers, filters, drain drums) that is to be used for collecting and recovering the absorbent/solvent for re-use or disposal;
- mechanical fluid circulation equipment (e.g., blowers, fans, pumps) that is to be used for moving process streams and fluids;
- tanks for handling materials that are to be used for the carbon capture process, including surge tanks and holding tanks for absorbent/solvent, antifoaming agents, process waste, nitrogen, and other chemicals, as well as equipment that is used to maintain the chemicals and fluids at the necessary storage conditions; and
- any other property that is described in Class 57 in relation to a carbon capture process, including, but not limited to, ancillary equipment, monitoring and control equipment, and building or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

Certain property that supports an absorbent/solvent-based carbon capture process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, may also be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates heat energy in support of a qualified CCUS project;
- generation equipment that generates electrical energy in support of a qualified CCUS project;
- generation equipment that generates a combination of electrical and heat energy in support of a qualified CCUS project;
- distribution equipment that distributes heat energy in support of a qualified CCUS project;
- distribution equipment that distributes electrical energy in support of a qualified CCUS project;
- transmission equipment that transmits electrical energy in support of a qualified CCUS project; and
- water use equipment that delivers, collects, recovers, treats, or recirculates water, or a combination of any of those activities, in support of a qualified CCUS project.

Raw CO_2 pre-treatment and CO_2 purification and compression processes are often integrated with carbon capture processes and certain property, described in Class 57 subparagraphs (a)(i)-(ii) of the Regulations, may be Class 57 Property. Please refer to Sections 2.1 and 2.3 for more information on Class 57 Property in the raw CO_2 pre-treatment and CO_2 purification and compression process, respectively.

3.1.3 Typical Property Not Included in Class 57

Property used in the absorbent/solvent-based carbon capture process that is not Class 57 Property is ineligible for the CCUS tax credit. Examples of typical property not included in Class 57 include the following:

- equipment used in an absorbent/solvent-based carbon capture process that is also used in a non-CCUS process (e.g., hydrogen production process, industrial process) and is therefore not used solely for a CCUS process, such as:
    - pre-treatment equipment (e.g., desulfurizers, SCRs, electrostatic precipitators, catalytic converters, filters, and similar equipment) that is used for removing impurities (e.g., H_2S, SO_x, NO_x, PM) from incoming raw CO_2 streams;
    - pre-treatment cooling equipment (e.g., DCCs, condensing economizers, intercoolers, condensers, cooling water heat exchangers, knock-out drums, dryers, and filters) that is used for cooling incoming raw CO_2 streams;
    - purge gas treatment equipment (e.g., wash water absorption vessels, fluid circulation equipment, cooling equipment, pressure swing adsorption equipment, and ancillary equipment) that is required for treating purge gas for use in a production-related process that is not a CCUS process;
- equipment that is used for removal of CO_2 or acid gas as part of natural gas processing; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note, this list is not exhaustive and is meant to provide general guidance on typical property used in an absorbent/solvent-based carbon capture process that is not Class 57 Property.

3.1.4 Typical Capital Costs Included in Class 57

Typical capital costs when constructing an absorbent/solvent-based carbon capture process that is part of a CCUS project would include the costs provided in Table 3.1-1:

Table 3.1-1 Project cost table for absorption/solvent-based carbon capture processes

Capital cost of Class 57 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. **These costs may be attributed to the following technical applications as part of an absorbent/solvent-based carbon capture process, provided the property is Class 57 Property such as, but not limited to, the Class 57 Property described in Section 3.1.2 or Section** 1.5.1**:**	
1	CO_2 absorption and stripping equipment
2	Lean absorbent/solvent recovery, purification, collection, and recirculation equipment
3	Heat recovery and cooling equipment
4	Mechanical fluid circulation equipment
5	Pre-treatment equipment – see Section 2.1 for details
6	CO_2 purification and compression equipment – see Section 2.2 for details
7	Heat generation equipment – see Section 2.2 for details
8	Heat distribution equipment – see Section 2.2 for details
9	Electricity generation equipment – see Section 2.2 for details
10	Electricity distribution equipment – see Section 2.2 for details
11	Electricity transmission equipment – see Section 2.2 for details
12	Process water stream delivery, collection, recovery, treatment, and recirculation equipment – see Section 2.2 for details
13	Electrical system equipment
14	Liquid delivery and distribution equipment
15	Utility cooling system equipment
16	Material handling and storage and distribution system equipment, including holding tanks, conditioning equipment, and fluid transfer equipment
17	Venting system equipment
18	Process waste management system equipment
19	Compressed utility air or nitrogen system equipment
20	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
21	Process safety equipment
22	Flow control and containment equipment
23	Buildings or other structures
24	Equipment for conversion of existing property into Class 57 Property
25	Equipment for refurbishment of existing Class 57 Property

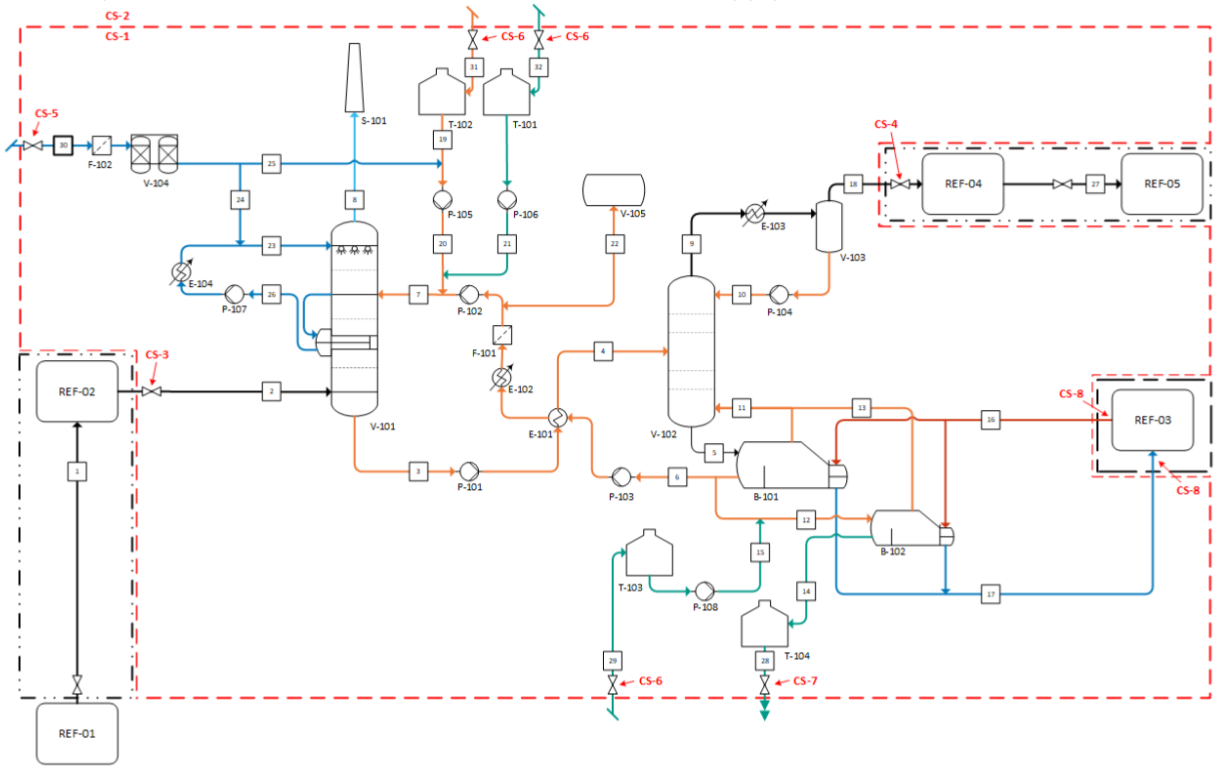
3.1.5 Schematic for Class 57 Property in Absorbent/Solvent-Based Carbon Capture Processes

Some typical elements of a CCUS process that can capture CO_2 using absorbent/solvent-based technology are shown in Figure 3.1-1. Process boundaries described here are for a typical absorbent/ solvent-based carbon capture process, using a schematic of an amine solvent-based carbon capture process as a representative example.

However, note that the specific property that is used in an absorbent/solvent-based carbon capture process may depend on the specific application and the type of absorbent/solvent used in the CCUS process. Ultimately, whether particular property is Class 57 Property will depend on its function within the CCUS process.

Additional equipment not listed may still be Class 57 Property and can include fluidized bed reactors and other novel reactors, enzymatic-enhanced absorption and regeneration columns, refrigeration loops, distillation columns, flash, wash, and separation vessels, and, in some circumstances, supporting equipment such as cooling, heating, and fluid circulation equipment. Typical absorbents/solvents that may be used in absorbent/solvent-based carbon capture processes and could necessitate different equipment requirements include chemical solvents such as amines, carbonates, ionic liquids, and amine-based blends, or physical solvents such as methanol, carbonates, and organic solvents — such as dimethyl ethers and morpholines.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 3, please refer to Section 3.6. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
B-101	Boiler	Regeneration Reboiler
B-102	Boiler	Absorbent/Solvent Reclaimer
E-101	Heat Exchanger	Absorbent/Solvent Cross HEX
E-102	Heat Exchanger	Lean Absorbent/Solvent Cooling Water HEX
E-103	Heat Exchanger	Reflux Cooling Water HEX
E-104	Heat Exchanger	Wash Water Cooling HEX
F-101	Filter	Absorbent/Solvent Filter
F-102	Filter	Activated Carbon Water Filter
P-101	Pump	Rich Absorbent/Solvent Pump
P-102	Pump	Filtered Lean Absorbent/Solvent Pump
P-103	Pump	Unfiltered Lean Absorbent/Solvent Pump
P-104	Pump	Reflux Return Pump
P-105	Pump	Anti-Foam Pump
P-106	Pump	Fresh Absorbent/Solvent Pump
P-107	Pump	Wash Water Pump
P-108	Pump	Chemical Injection Pump
S-101	Vent Stack	Treated Gas Vent
T-101	Chemical Tank	Anti-Foam Storage Tank
T-102	Chemical Tank	Absorbent/Solvent Make-up Tank
T-103	Chemical Tank	Reclaimer Chemical Tank
T-104	Chemical Tank	Reclaimer Sludge Tank
V-101	Trayed Column	Absorption Column
V-102	Trayed Column	Regeneration Column
V-103	Gas-Liquid Separator	Reflux Drum
V-104	Fixed Bed Vessel	Ion Exchange System
V-105	Surge Tank	Absorbent/Solvent Surge Tank

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Cool Rich Absorbent/Solvent
4	Hot Rich Absorbent/Solvent
5	Regenerator Bottom Product
6	Hot Lean Absorbent/Solvent
7	Cool Lean Absorbent/Solvent
8	CO_2-Lean Vent Gas
9	Regenerator Top Product
10	Regenerator Reflux
11	Reboiled Absorbent/Solvent
12	Reclaimer Absorbent/Solvent Slip-Stream
13	Reclaimer Absorbent/Solvent Return
14	Reclaimer Sludge
15	Reclaimer Chemical Feed
16	Steam Feed
17	Steam Condensate Return
18	Captured CO_2
19	Pure Absorbent/Solvent Make-Up
20	Aqueous Absorbent/Solvent Make-Up
21	Anti-Foam Feed
22	Reversible Surge Tank Line
23	Wash-Water Feed
24	Wash-Water Make-Up
25	Make-Up Absorbent/Solvent Water Line
26	Absorber Intercooler Return
27	Compressed and Purified CO_2
28	Reclaimer Sludge Removal
29	Reclaimer Chemical Fill Line
30	Raw Water Inlet
31	Absorbent/Solvent Tank Fill Line
32	Anti-Foam Tank Fill Line

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	Power and/or Heat and Water	Section 2.2
REF-04	CO_2 Compression and Purification	Section 2.3
REF-05	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

- CO_2
- Water
- Absorbent/Solvent
- Steam
- Chemical
- Air

Class 57 Property for a Solvent/Absorbent-Based Carbon Capture Process

Other Class 57 Property or Class 58 Property

Other Class 57 Property or Dual-use Property

Figure 3.1-1: An example of an absorbent/solvent-based carbon capture process that uses an amine solvent.

Figure Text Description: Diagram illustrating the boundaries of an amine solvent carbon capture process. The boundary begins at CS-3 (see section 3.6) after a raw CO_2 stream pre-treatment process, and includes equipment such as boilers, heat exchangers, filters, pumps, storage tanks for the solvents and absorption and regeneration columns. The boundary ends at CS-4 where a CO_2 purification and compression process begins. Boundaries on secondary streams used within the equipment within an amine carbon capture process boundary include CS-5 for water streams, CS-6 for solvent streams, CS-6 for chemical streams, CS-7 for waste streams and CS-8 for steam. For notes on process boundaries for this schematic and all other schematics in Section 3, please refer to Section 3.6, but not all notes apply to each schematic.

3.2 Solid Adsorption Carbon Capture

3.2.1 Solid Adsorption Carbon Capture Processes

Solid adsorption carbon capture processes use equipment featuring chemical or physical adsorption technology to separate CO_2 for the purpose of capturing it.

Property that is part of a solid adsorption carbon capture process, which is a subset of technology within carbon capture processes (described in Class 57 clause (a)(i)(A)), could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for capturing carbon dioxide that would otherwise be released into the atmosphere, is not oxygen production equipment, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
    - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

3.2.2 Pertinent Class 57 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process where solid adsorption carbon capture is the primary technology will be based on the definitions set out in the Act and the Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 3.2.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed.

Solid adsorption carbon capture processes include, but are not limited to, pressure swing adsorption (PSA), vacuum swing adsorption (VSA), and temperature swing adsorption (TSA). These processes represent prominent processes and are described in this Guide.

Examples of Class 57 Property could include, but are not limited to, the following:

- pressure/vacuum swing adsorption and desorption equipment (e.g., packed bed contactor) that is to be used for separating CO_2 from other gases in a gaseous stream, including multi-bed configurations to allow for continuous operation during adsorption/desorption cycles and when necessary, equipment for pressurization (e.g., high-pressure valves, actuators, knockout drums):
  - mechanical pressurization and circulation equipment (e.g., compressors, blowers, fans, pumps) that is to be used to pressurize and circulate gases, enabling operation of PSA and VSA cycles; and
  - vacuum pump and vacuum pump support systems that are to be used for vessel depressurization within the operation of VSA in the CCUS process;
- temperature swing adsorption and desorption equipment (e.g., fixed/moving/fluidized bed contactors) that is to be used for separating CO_2 from other gases through the application of heat energy, including multi-bed configurations to allow for continuous operation and equipment for solid material handling (e.g., rotary conveyors, cyclones, particle filters);
- heat exchange equipment (e.g., heat exchangers, condensers, economizers) that is to be used for process stream temperature control and energy conservation;
- cooling equipment (e.g., direct contact coolers, intercoolers, condensers, economizers, cooling towers, heat exchangers) that is to be used for maintaining the operating temperature of the adsorption or desorption contactors;
- mechanical fluid circulation equipment (e.g., blowers, fans, pumps) that is to be used for moving process streams and fluids;
- waste separation equipment (e.g., spent sorbent collection, air filters, cyclones) that is to be used for separating and collecting waste;
- tanks and other holding vessels required for the handling of liquid, solid, and gaseous materials that are to be used for the carbon capture process; and
- any other property that is described in Class 57 in relation to a carbon capture process, including, but not limited to, ancillary equipment, monitoring and control equipment, and buildings or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

Certain property that supports a solid adsorption carbon capture process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, may also be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates heat energy in support of a qualified CCUS project;
- generation equipment that generates electrical energy in support of a qualified CCUS project;
- generation equipment that generates a combination of electrical and heat energy in support of a qualified CCUS project;
- distribution equipment that distributes heat energy in support of a qualified CCUS project;
- distribution equipment that distributes electrical energy in support of a qualified CCUS project;

- transmission equipment that transmits electrical energy in support of a qualified CCUS project; and
- water use equipment that delivers, collects, recovers, treats, or recirculates water, or a combination of any of those activities, in support of a qualified CCUS project.

Raw CO_2 pre-treatment and CO_2 purification and compression processes are often integrated with carbon capture processes and certain property, described in Class 57 subparagraphs (a)(i)-(ii) of the Regulations, may be Class 57 Property. Please refer to Sections 2.1 and 2.3 for more information on Class 57 Property in the raw CO_2 pre-treatment and CO_2 purification and compression process, respectively.

3.2.3 Typical Property Not Included in Class 57

Property used in the solid adsorption carbon capture process that is not Class 57 Property is ineligible for the CCUS Tax Credit. Examples of typical property not included in Class 57 include the following:

- equipment used in a solid adsorption carbon capture process that is also used in a non-CCUS process (e.g., hydrogen production process, industrial process) and is therefore not used solely for a CCUS process, such as:
    - pre-treatment equipment (e.g., desulfurizers, SCRs, electrostatic precipitators, catalytic converters, filters, and similar equipment) that is used for removing impurities (e.g., H_2S, SO_x, NO_x, PM) from incoming raw CO_2 streams;
    - pre-treatment cooling equipment (e.g., DCCs, condensing economizers, intercoolers, condensers, cooling water heat exchangers, knock-out drums, dryers, and filters) that is used for cooling incoming raw CO_2 streams;
    - purge gas treatment equipment (e.g., wash water absorption vessels, fluid circulation equipment, cooling equipment, pressure swing adsorption equipment, and ancillary equipment) that is required for treating purge gas for use in a production-related process that is not a CCUS process;
- equipment that is used for removal of CO_2 or acid gas as part of natural gas processing; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note, this list is not exhaustive and is meant to provide general guidance on typical property used in a solid adsorption carbon capture process that is not Class 57 Property.

3.2.4 Typical Capital Costs Included in Class 57

Typical capital costs when constructing a solid adsorption carbon capture process that is part of a CCUS project would include the costs provided in Table 3.2-1:

Table 3.2-1 Project cost table for solid adsorption carbon capture processes

Capital cost of Class 57 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. **These costs may be attributed to the following technical applications as part of a solid absorption-based carbon capture process, provided the property is Class 57 Property such as, but not limited to, the Class 57 Property described in Section** 3.2.2 **or Section** 1.5.1**:**	
1	Adsorption and desorption system equipment, including solids handling, gas handling, and heat transfer equipment
2	Gaseous compression and decompression equipment
3	Heat exchange and cooling equipment
4	Mechanical fluid circulation equipment
5	Pre-treatment equipment – see Section 2.1 for details
6	CO_2 purification and compression equipment – see Section 2.2 for details
7	Heat generation equipment – see Section 2.2 for details
8	Heat distribution equipment – see Section 2.2 for details
9	Electricity generation equipment – see Section 2.2 for details
10	Electricity distribution equipment – see Section 2.2 for details
11	Electricity transmission equipment – see Section 2.2 for details
12	Process water stream delivery, collection, recovery, treatment, and recirculation equipment – see Section 2.2 for details
13	Electrical system equipment
14	Liquid delivery and distribution equipment
15	Utility cooling system equipment
16	Material handling and storage and distribution system equipment, including holding tanks, conditioning equipment, and fluid transfer equipment
17	Venting system equipment
18	Process waste management system equipment
19	Compressed utility air or nitrogen system equipment
20	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
21	Process safety equipment
22	Flow control and containment equipment
23	Buildings or other structures
24	Equipment for conversion of existing property into Class 57 Property
25	Equipment for refurbishment of existing Class 57 Property

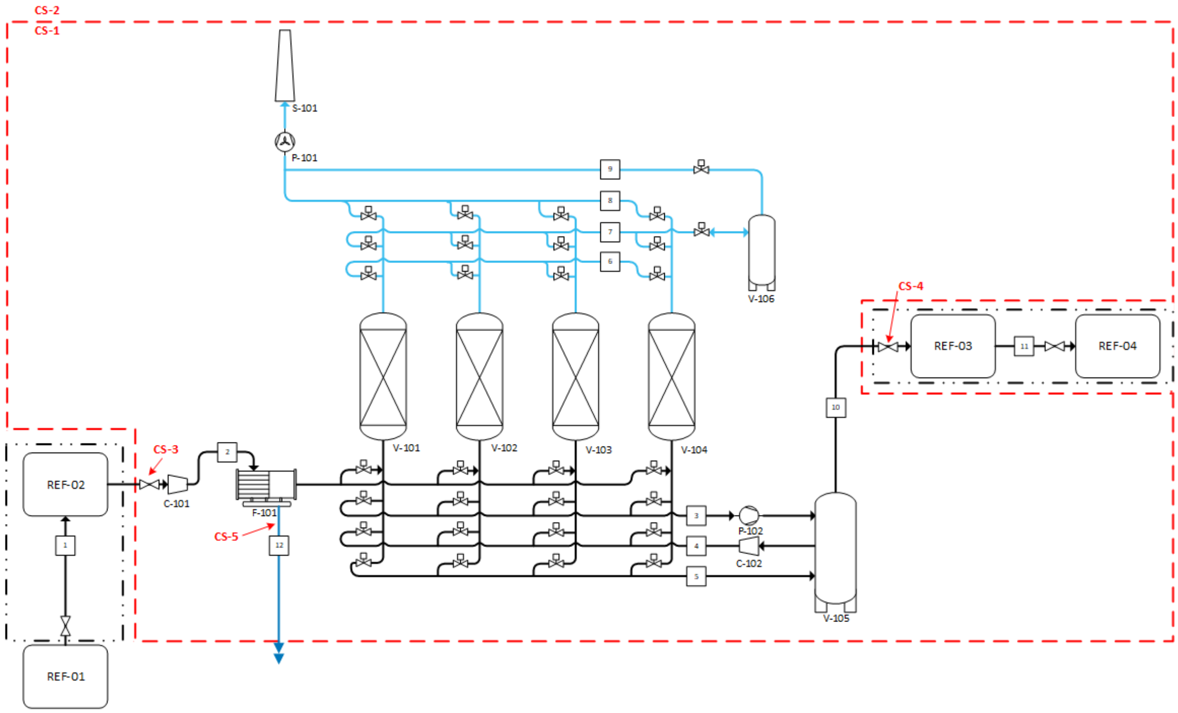
3.2.5 Schematics for Class 57 Property in Solid Adsorption Carbon Capture Processes

Some typical elements of a CCUS process that can capture CO_2 using solid adsorption technology are shown in Figure 3.2-1 and Figure 3.2-2. Process boundaries defined here are for typical solid adsorption carbon capture processes, using schematics of a PSA and a TSA carbon capture process, respectively, as representative examples.

However, note that the specific property that is used in a solid adsorption carbon capture process may depend on the specific application and the type of adsorbent used in the CCUS process. Ultimately, whether particular property is Class 57 Property will depend on its function within the CCUS process.

Additional equipment not listed may still be Class 57 Property and can include fixed, moving, or fluidized bed contactors, additional contactors to allow for a higher or lower number of adsorption stages, combination processes (e.g., pressure-vacuum swing adsorption), and novel swing processes (partial pressure, concentration, electrostatic swing adsorption). Common adsorbents that may be used in adsorption-based carbon capture processes include amine-functionalized metal organic frameworks (MOFs) and covalent organic frameworks (COFs), zeolites, mesoporous silica, porous organic polymers (POP), and metal oxides.

NOTE: For keys to the process boundary notes on these schematics, as well as the other schematics in Section 3, please refer to Section 3.6. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	Pretreated CO_2 Compressor
C-102	Compressor	CO_2 Purge Compressor
F-101	Coalescing Filter	CO_2 Inlet Coalescing Filter
P-101	Blower	Stack Blower
P-102	Vacuum Pump	Vacuum Pump
S-101	Stack	Air Vent Stack
V-101	Packed Bed	Adsorption Column 1
V-102	Packed Bed	Adsorption Column 2
V-103	Packed Bed	Adsorption Column 3
V-104	Packed Bed	Adsorption Column 4
V-105	Pressure Vessel	CO_2 Product Tank
V-106	Pressure Vessel	Air Buffer Tank

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Treated CO_2
4	CO_2 Purge Line
5	Equalization Line
6	Equalization Line
7	Buffer Tank Line
8	Treated CO_2-Lean Gas Purge Line
9	Buffer Tank Purge Line
10	Captured CO_2
11	Compressed and Purified CO_2
12	Reject Condensate

Reference Identifier	Referenced Plant Section
REF-01	CO_2 Source Process
REF-02	Raw CO_2 Pre-Treatment
REF-03	CO_2 Compression and Purification
REF-04	CO_2 Transportation and CO_2 Storage/Use

Stream Legend

CO_2
Air
Water

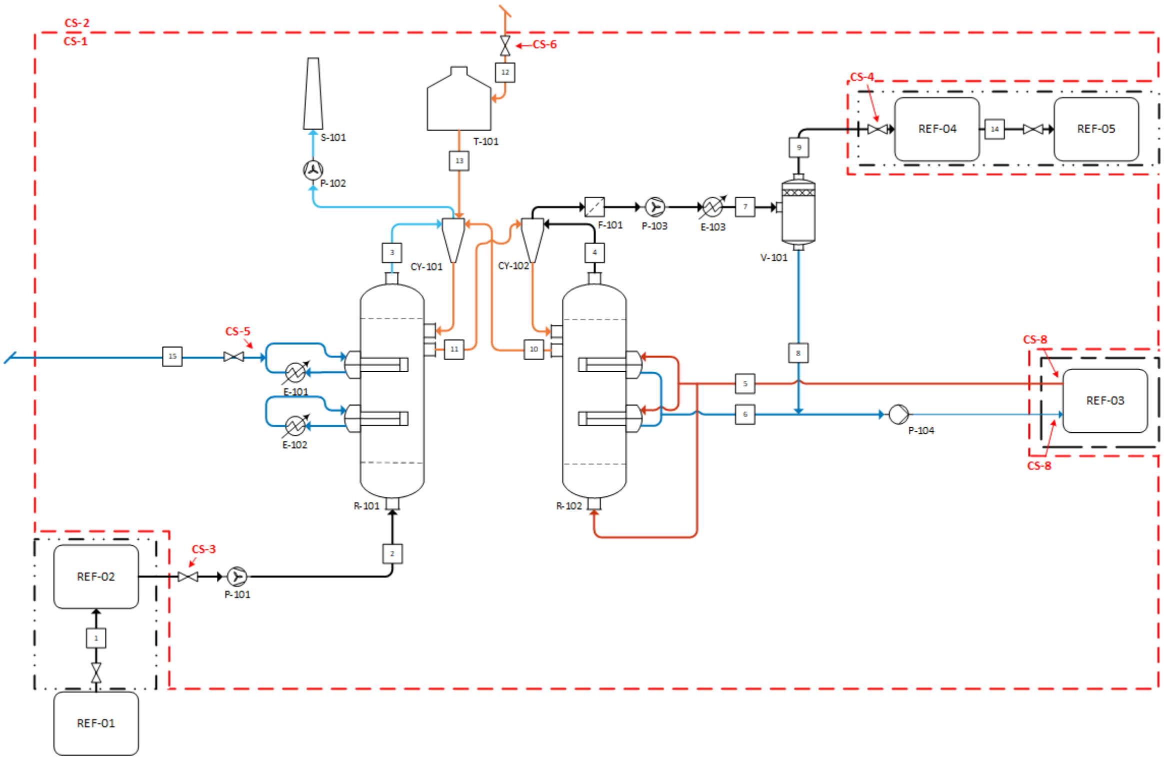
Class 57 Property for a Pressure Swing Adsorption Carbon Capture Process

Other Class 57 Property or Class 58 Property

Figure 3.2-1: An example of a solid adsorption carbon capture process that uses pressure swing adsorption.

Figure Text Description: Diagram illustrating the boundaries of a pressure swing adsorption process. The boundary begins at CS-3 (see section 3.6) after a raw CO_2 pre-treatment process, and includes equipment such as adsorption columns, compressors, coalescing filters, and pressure vessels, the boundary ends at CS-4 where a CO_2 purification and compression process begins. The boundary on the water effluent stream from the coalescing filter is CS-5. For notes on process boundaries for this schematic and all other schematics in Section 3, please refer to Section 3.6, but not all notes apply to each schematic.

<u>NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 3, please refer to Section 3.6. Note that not all notes apply to each schematic.</u>



Equipment Identifier	Equipment Type	Equipment Description
CY-101	Cyclone	Lean Adsorbent Cyclone
CY-102	Cyclone	Rich Adsorbent Cyclone
E-101	Heat Exchanger	Adsorber Cooling Water Intercooler 1
E-102	Heat Exchanger	Adsorber Cooling Water Intercooler 2
E-103	Heat Exchanger	CO_2 Cooling Water HEX
F-101	Filter	CO_2 Particulate Filter
P-101	Blower	Pretreated CO_2 Blower
P-102	Blower	Depleted Air Blower
P-103	Blower	Treated CO_2 Blower
P-104	Pump	Condensate Pump
R-101	Fluidized Bed Reactor	Fluidized Bed Adsorber
R-102	Fluidized Bed Reactor	Fluidized Bed Regenerator
S-101	Vent Stack	Treated Gas Vent
T-101	Chemical Tank	Solid Adsorbent Holding Tank
V-101	Gas-Liquid Separator	Steam Condensate Knockout

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Cool CO_2-Lean Gas
4	Cool CO_2-Rich Gas
5	Adsorber Steam Supply
6	Steam Condensate Return
7	Wet Treated CO_2
8	Condensate Return
9	Dried CO_2
10	Lean Adsorbent
11	Rich Adsorbent
12	Solid Adsorbent Tank Fill
13	Solid Adsorbent Make-up Line
14	Compressed and Purified CO_2
15	Feed Water

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	Power and/or Heat and Water	Section 2.2
REF-04	CO_2 Compression and Purification	Section 2.3
REF-05	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

CO_2
Water
Steam
Air
Adsorbent

Class 57 Property for a Temperature Swing Adsorption Carbon Capture Process

Other Class 57 Property or Class 58 Property

Other Class 57 Property or Dual-use Property

Figure 3.2-2: An example of a solid adsorption carbon capture process that uses temperature swing adsorption.

Figure Text Description: Diagram illustrating the boundaries of a temperature swing adsorption process. The boundary begins at CS-3 (see section 3.6) after a raw CO_2 pre-treatment process, and includes equipment such as cyclones, heat exchangers, blowers, and adsorber and regeneration reactors. The boundary ends at CS-4 where a CO_2 purification and compression process begins. Boundaries on secondary streams needed for the equipment within the boundary for a temperature swing adsorption process include CS-5 for water, CS-6 for inlet of adsorbent streams, and CS-8 for steam and water streams which interact with the power and/or heat and water process boundary (section 2.2). For notes on process boundaries for this schematic and all other schematics in Section 3, please refer to Section 3.6, but not all notes apply to each schematic.

3.3 Membrane Carbon Capture

3.3.1 Membrane Carbon Capture Processes

Membrane-based carbon capture processes use equipment featuring membrane technology to separate CO_2 for the purpose of capturing it.

Property that is part of a membrane-based carbon capture process, which is a subset of technology within carbon capture processes (described in Class 57 clause (a)(i)(A)), could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
  - the property is to be used solely for capturing carbon dioxide that would otherwise be released into the atmosphere, is not oxygen production equipment, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
  - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

3.3.2 Pertinent Class 57 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process where membrane-based carbon capture is the primary technology will be based on the definitions set out in the Act and the Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 3.3.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, the following:

- CO_2 separation equipment (e.g., membrane modules) that is to be used for separating CO_2 from other components in the emission stream, including other carbon capture processes for CO_2 separation that use membrane modules in conjunction with for example, absorbent/solvent-based absorption, solid adsorption, or cryogenic separation equipment (i.e., hybrid processes);
- mechanical fluid circulation equipment (e.g., blowers, fans, pumps, compressors, and expanders) that is to be used for moving process streams and fluids;
- cooling equipment (e.g., direct contact coolers, condensing economizers, intercoolers, condensers, cooling heat exchangers) that is to be used for reducing process stream temperature to facilitate efficient CO_2 separation via the membrane; and

- any other property that is described in Class 57 in relation to a carbon capture process, including, but not limited to, ancillary equipment, monitoring and control equipment, and buildings or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

Certain property that supports a membrane-based carbon capture process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, may also be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates electrical energy in support of a qualified CCUS project;
- distribution equipment that distributes electrical energy in support of a qualified CCUS project;
- transmission equipment that transmits electrical energy in support of a qualified CCUS project; and
- water use equipment that delivers, collects, recovers, treats, or recirculates water, or a combination of any of those activities, in support of a qualified CCUS project.

Raw CO_2 pre-treatment and CO_2 purification and compression processes are often integrated with carbon capture processes and certain property, described in Class 57 subparagraphs (a)(i)-(ii) of the Regulations may be Class 57 Property. Please refer to Sections 2.1 and 2.3 for more information on Class 57 Property in the raw CO_2 pre-treatment and CO_2 purification and compression process, respectively.

3.3.3 Typical Property Not Included in Class 57

Property used in the membrane-based carbon capture process that is not Class 57 Property is ineligible for the CCUS Tax Credit. Examples of typical property not included in Class 57 include the following:

- equipment used in a membrane-based carbon capture process that is also used in a non-CCUS process (e.g., hydrogen production process, industrial process) and is therefore not used solely for a CCUS process, such as:
    - pre-treatment equipment (e.g., desulfurizers, SCRs, electrostatic precipitators, catalytic converters, filters, and similar equipment) that is used for removing impurities (e.g., H_2S, SO_x, NO_x, PM) from incoming raw CO_2 streams;
    - pre-treatment cooling equipment (e.g., DCCs, condensing economizers, intercoolers, condensers, cooling water heat exchangers, knock-out drums, dryers, and filters) that is used for cooling incoming raw CO_2 streams;
    - purge gas treatment equipment (e.g., wash water absorption vessels, fluid circulation equipment, cooling equipment, pressure swing adsorption equipment, and ancillary equipment) that is required for treating purge gas for use in a production-related process that is not a CCUS process;
- equipment that is used for removal of CO_2 or acid gas as part of natural gas processing; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note, this list is not exhaustive and is meant to provide general guidance on typical property used in a membrane-based carbon capture process that is not Class 57 Property.

3.3.4 Typical Capital Costs Included in Class 57

Typical capital costs when constructing a membrane-based carbon capture process that is part of a CCUS project would include the costs provided in Table 3.3-1:

Table 3.3-1 Project cost table for membrane-based carbon capture processes

Capital cost of Class 57 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. **These costs may be attributed to the following technical applications as part of a membrane-based carbon capture process, provided the property is Class 57 Property such as, but not limited to, the Class 57 Property described in Section** 3.3.2 **or Section** 1.5.1**:**	
1	Membrane system equipment
2	Cooling equipment
3	Mechanical fluid circulation equipment
4	Pre-treatment equipment – see Section 2.1 for details
5	CO_2 purification and compression equipment – see Section 2.2 for details
6	Electricity generation equipment – see Section 2.2 for details
7	Electricity distribution equipment – see Section 2.2 for details
8	Electricity transmission equipment – see Section 2.2 for details
9	Process water stream delivery, collection, recovery, treatment, and recirculation equipment – see Section 2.2 for details
10	Electrical system equipment
11	Utility cooling system equipment
12	Venting system equipment
13	Process waste management system equipment
14	Compressed utility air or nitrogen system equipment
15	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
16	Process safety equipment
17	Flow control and containment equipment
18	Buildings or other structures
19	Equipment for conversion of existing property into Class 57 Property
20	Equipment for refurbishment of existing Class 57 Property

3.3.5 Schematics for Class 57 Property in Membrane Carbon Capture Processes

Some typical elements of a CCUS process that can capture CO_2 using membrane-based technology are shown in Figure 3.3-1 and Figure 3.3-2. Process boundaries defined here are for typical membrane-based carbon capture processes, using schematics of a two-stage membrane-based carbon capture process and a generic hybrid carbon capture process, respectively, as representative examples.

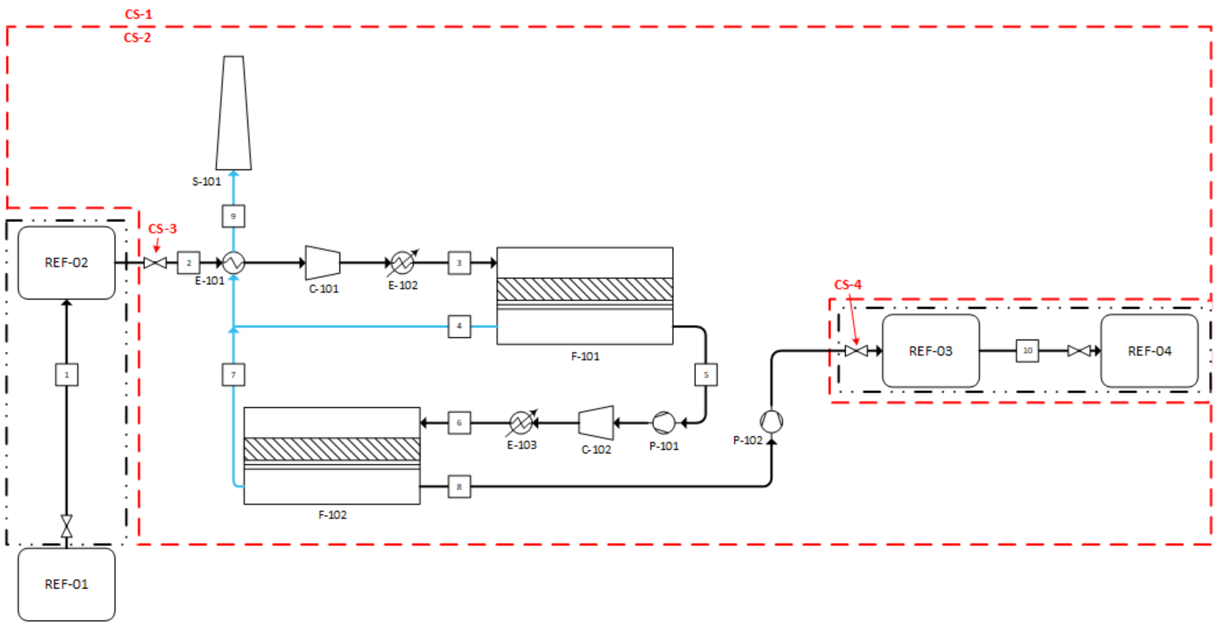
However, note that the specific property that is used in a membrane-based carbon capture process may depend on the specific application and configuration of the membrane system used in the CCUS process. Ultimately, whether particular property is Class 57 Property will depend on its function within the CCUS process.

In cases where the CO_2 stream must achieve high purity levels, membrane technology can be combined with other carbon capture technologies such as:

- amine-based solvent technology that often uses liquid solvents;
- PSA technology that uses solid adsorbents; and
- cryogenic separation technology that liquefies or solidifies CO_2 to separate it from light gases.

For more information on absorbent/solvent-based technology please refer to Section 3.1, for PSA solid adsorption technology please refer to Section 3.2, and for cryogenic separation technology please refer to Section 3.4 of this Guide document.

NOTE: For keys to the process boundary notes on these schematics, as well as the other schematics in Section 3, please refer to Section 3.6. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	Membrane 1 Compressor
C-102	Compressor	Membrane 2 Compressor
E-101	Heat Exchanger	Permeate Air Economizer
E-102	Heat Exchanger	Membrane 1 Cooling Water Exchanger
E-103	Heat Exchanger	Membrane 2 Cooling Water Exchanger
F-101	Membrane Filter	CO_2 Separation Membrane 1
F-102	Membrane Filter	CO_2 Separation Membrane 2
P-101	Vacuum Pump	Membrane 1 Vacuum Pump
P-102	Vacuum Pump	Membrane 2 Vacuum Pump
S-101	Stack	Treated CO_2-Lean Gas Stack

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Membrane 1 Feed
4	Cold Treated CO_2-Lean Gas
5	Partially Concentrated CO_2
6	Membrane 2 Feed
7	Cold Treated CO_2-Lean Gas
8	Captured CO_2
9	Warm Treated CO_2-Lean Gas
10	Compressed and Purified CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Compression and Purification	Section 2.3
REF-04	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

Black arrow	CO_2
Blue arrow	Air

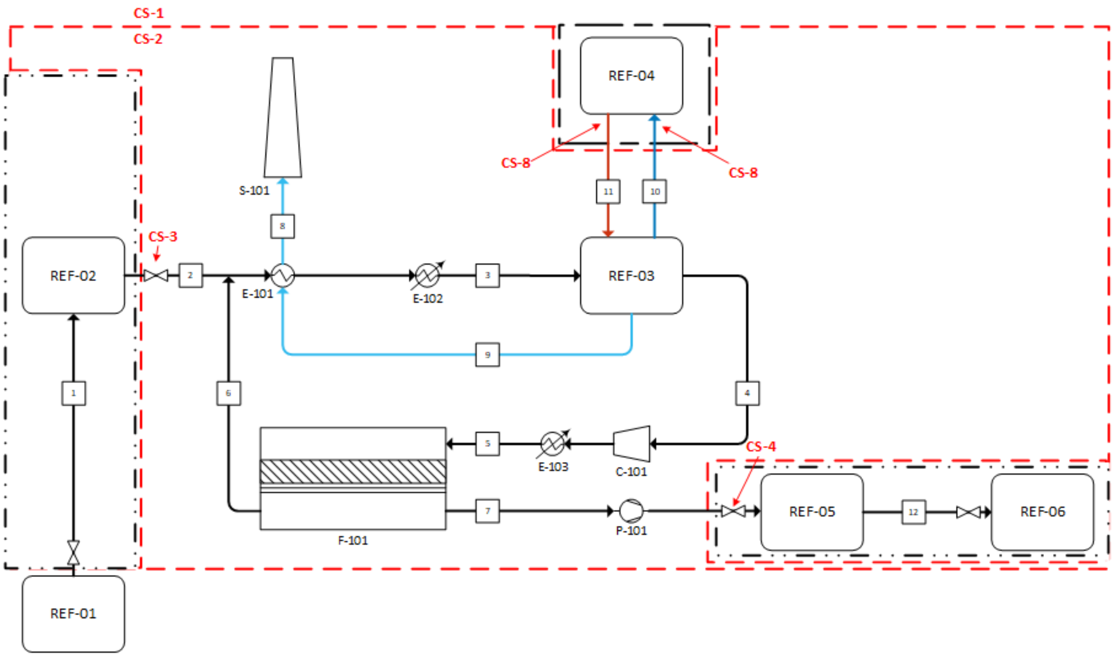
Class 57 Property for a Membrane Carbon Capture Process

Other Class 57 Property or Class 58 Property

Figure 3.3-1: An example of a membrane carbon capture process that uses a two-stage membrane technology.

Figure Text Description: Diagram illustrating the boundaries of a membrane carbon capture process. The boundary begins at CS-3 (see section 3.6) after a raw CO_2 pre-treatment process, and includes equipment such as compressors, heat exchangers, membrane filters, and vacuum pumps. The boundary ends at CS-4 where a CO_2 purification and compression process begins. For notes on process boundaries for this schematic and all other schematics in Section 3, please refer to Section 3.6, but not all notes apply to each schematic.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 3, please refer to Section 3.6. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	Membrane Feed Compressor
E-101	Heat Exchanger	Permeate Air Economizer
E-102	Heat Exchanger	Capture Feed Cooling Water Exchanger
E-103	Heat Exchanger	Membrane Feed Cooling Water Exchanger
F-101	Membrane Filter	CO_2 Separation Membrane
P-101	Vacuum Pump	Membrane Vacuum Pump
S-101	Stack	Treated Air Stack

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Capture Process Feed
4	Partially Concentrated CO_2
5	Membrane Feed
6	CO_2 Recycle
7	Captured CO_2
8	Warm Treated CO_2-Lean Gas
9	Cold Treated CO_2-Lean Gas
10	Condensate Return
11	Capture Steam Feed
12	Compressed and Purified CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	–
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Capture Process	Section 3
REF-04	Power and/or Heat and Water	Section 2.2
REF-05	CO_2 Compression and Purification	Section 2.3
REF-06	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

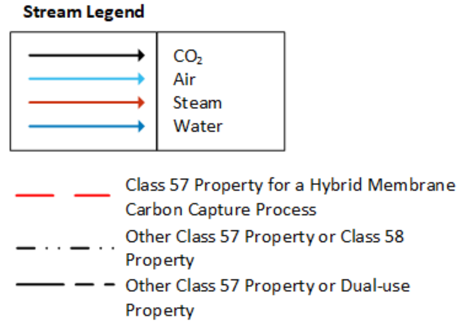


Figure 3.3-2 An example of a membrane carbon capture process that uses a hybrid process with membrane technology and another carbon capture technology.

Figure Text Description: Diagram illustrating the boundaries of a hybrid membrane carbon capture process. The boundary begins at CS-3 (see section 3.6) after a raw CO_2 pre-treatment process, and includes equipment such as compressors, heat exchangers, membrane filters, and vacuum pumps. The boundary ends at CS-4 where a CO_2 purification and compression process begins. Boundaries on secondary streams needed for the equipment within the boundary for a hybrid membrane carbon capture process include CS-8 for effluent water streams and steam inlet streams which interact with the power and/or heat and water process boundary (section 2.2). For notes on process boundaries for this schematic and all other schematics in Section 3, please refer to Section 3.6, but not all notes apply to each schematic.

3.4 Cryogenic Carbon Capture

3.4.1 Cryogenic Carbon Capture Processes

Cryogenic carbon capture processes use equipment featuring cryogenic or hybrid cryogenic technology to separate CO_2 for the purpose of capturing it.

Property that is part of a cryogenic carbon capture process, which is a subset of technology within carbon capture processes (described in Class 57 clause (a)(i)(A)), could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for capturing carbon dioxide that would otherwise be released into the atmosphere, is not oxygen production equipment, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
    - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

3.4.2 Pertinent Class 57 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process where cryogenic carbon capture is the primary technology will be based on the definitions set out in the Act and the Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 3.4.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, the following:

- CO_2 separation equipment (e.g., cryogenic distillation columns, screw presses, cyclones) that is to be used for separating CO_2 from impurities and other gases (e.g., N_2, O_2, Ar), including equipment for fluid reflux (e.g., reflux drums and fluid circulation equipment) and equipment for reboiling (e.g., reboilers, condensate pots) when necessary, as well as equipment for treating incoming feedwater that is to be used as wash water (e.g., filters, ion exchange vessels, reverse osmosis systems);
- CO_2 expansion equipment (e.g., expanders, separation vessels) that is to be used for rapidly cooling and facilitating separation of CO_2 from other gases (e.g., N_2, O_2, Ar) and equipment for pumping, compression, and cryogenic/near-cryogenic pumps;

- heat recovery equipment (e.g., heat exchangers) that is to be used for controlling process stream temperature to facilitate pre-treatment and conditioning of the raw CO_2 stream to separate CO_2 from other gaseous compounds;
- cooling equipment (e.g., direct contact coolers, condensing economizers, intercoolers, condensers, cooling water heat exchangers, cooling towers) that is to be used for reducing process stream temperature to achieve cryogenic conditions;
- mechanical fluid circulation equipment (e.g., expanders, compressors, pumps) that is to be used for moving process streams and fluids;
- tanks for handling materials that are to be used for the CCUS process, including surge tanks and holding tanks for storing cryogenic fluids, refrigerants, and other chemicals, as well as equipment that is used to maintain the chemicals and fluids at the necessary storage conditions; and
- any other property that is described in Class 57 in relation to a carbon capture process, including, but not limited to, ancillary equipment, monitoring and control equipment, and building or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

Certain property that supports a cryogenic carbon capture process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, may also be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates heat energy in support of a qualified CCUS project;
- generation equipment that generates electrical energy in support of a qualified CCUS project;
- generation equipment that generates a combination of electrical and heat energy in support of a qualified CCUS project;
- distribution equipment that distributes heat energy in support of a qualified CCUS project;
- distribution equipment that distributes electrical energy in support of a qualified CCUS project;
- transmission equipment that transmits electrical energy in support of a qualified CCUS project; and
- water use equipment that delivers, collects, recovers, treats, or recirculates water, or a combination of any of those activities, in support of a qualified CCUS project.

Raw CO_2 pre-treatment and CO_2 purification and compression processes are often integrated with carbon capture processes and certain property, described in Class 57 subparagraphs (a)(i)-(ii) of the Regulations, may be Class 57 Property. Please refer to Sections 2.1 and 2.3 for more information on Class 57 Property in the raw CO_2 pre-treatment and CO_2 purification and compression process, respectively.

3.4.3 Typical Property Not Included in Class 57

Property used in the cryogenic carbon capture process that is not Class 57 Property is ineligible for the CCUS Tax Credit. Examples of typical property not included in Class 57 include the following:

- equipment used in a cryogenic carbon capture process that is also used in a non-CCUS process (e.g., hydrogen production process, industrial process) and is therefore not used solely for a CCUS process, such as:
    - pre-treatment equipment (e.g., desulfurizers, SCRs, electrostatic precipitators, catalytic converters, filters, and similar equipment) that is used for removing impurities (e.g., H_2S, SO_x, NO_x, PM) from incoming raw CO_2 streams;
    - pre-treatment cooling equipment (e.g., DCCs, condensing economizers, intercoolers, condensers, cooling water heat exchangers, knock-out drums, dryers, and filters) that is used for cooling incoming raw CO_2 streams;
    - purge gas treatment equipment (e.g., wash water absorption vessels, fluid circulation equipment, cooling equipment, pressure swing adsorption equipment, and ancillary equipment) that is required for treating purge gas for use in a production-related process that is not a CCUS process;
- equipment that is used for removal of CO_2 or acid gas as part of natural gas processing; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note, this list is not exhaustive and is meant to provide general guidance on typical property used in a cryogenic carbon capture process that is not Class 57 Property.

3.4.4 Typical Capital Costs Included in Class 57

Typical capital costs when constructing a cryogenic carbon capture process that is part of a CCUS project would include the costs provided in Table 3.4-1:

Table 3.4-1 Project cost table for cryogenic carbon capture processes

Capital cost of Class 57 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. These costs may be attributed to the following technical applications as part of cryogenic carbon capture process, provided the property is Class 57 Property such as, but not limited to, the Class 57 Property described in Section 3.4.2 **or Section** 1.5.1**:**	
1	Cryogenic and hybrid cryogenic separation system equipment, including re-purification and recirculation, sublimation/deposition, and heat exchange equipment
2	Heat recovery and cooling equipment
3	Mechanical fluid circulation equipment
4	Pre-treatment equipment – see Section 2.1 for details
5	CO_2 purification and compression equipment – see Section 2.2 for details
6	Heat generation equipment – see Section 2.2 for details
7	Heat distribution equipment – see Section 2.2 for details
8	Electricity generation equipment – see Section 2.2 for details
9	Electricity distribution equipment – see Section 2.2 for details
10	Electricity transmission equipment – see Section 2.2 for details

11	Process water stream delivery, collection, recovery, treatment, and recirculation equipment – see Section 2.2 for details
12	Electrical system equipment
13	Liquid delivery and distribution equipment
14	Utility cooling system equipment
15	Material handling and storage and distribution system equipment, including holding tanks, conditioning equipment, and fluid transfer equipment
16	Venting system equipment
17	Process waste management system equipment
18	Compressed utility air or nitrogen system equipment
19	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
20	Process safety equipment
21	Flow control and containment equipment
22	Buildings or other structures
23	Equipment for conversion of existing property into Class 57 Property
24	Equipment for refurbishment of existing Class 57 Property

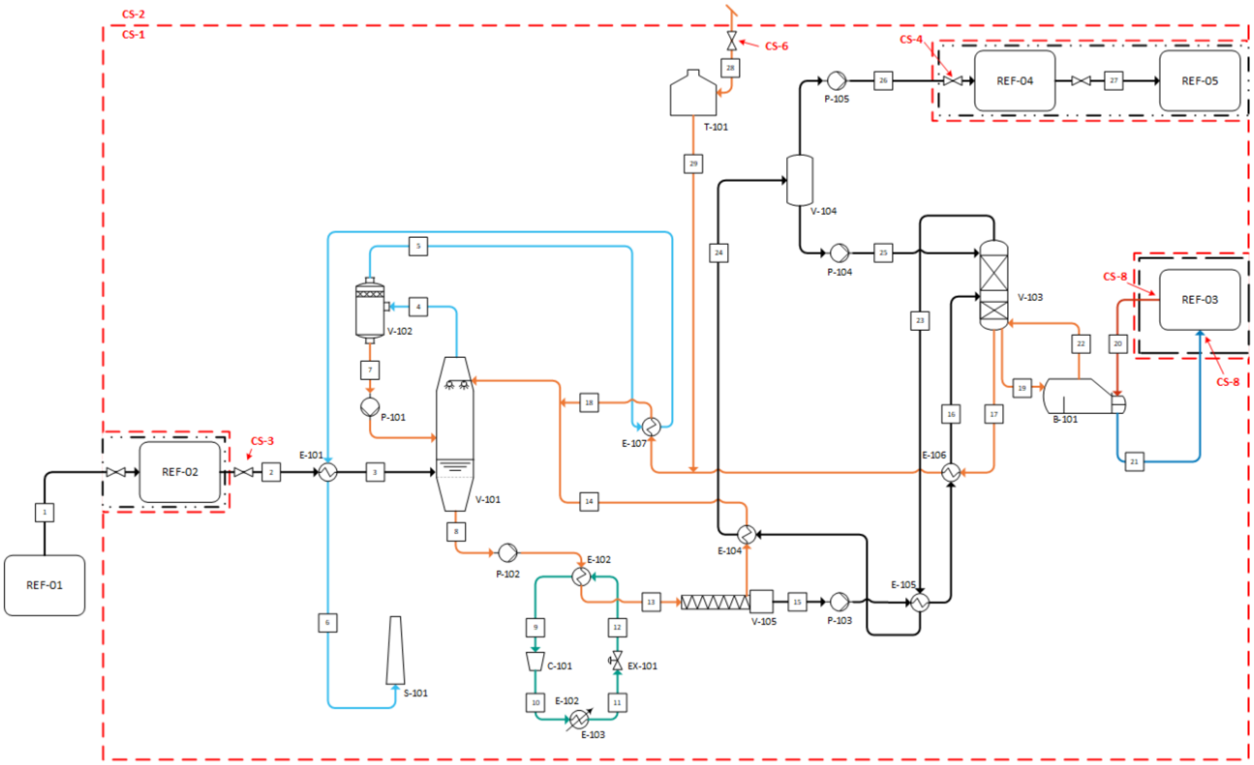
3.4.5 Schematics for Class 57 Property in Cryogenic Capture Processes

Some typical elements of a CCUS process that can capture CO_2 using cryogenic carbon capture technology are shown in Figure 3.4-1 and Figure 3.4-2. Process boundaries defined here are for typical cryogenic carbon capture processes, using schematics of an external cooling looping cryogenic carbon capture process and a compressed gas cryogenic carbon capture process, respectively, as representative examples.

However, note that the specific property that is used in a cryogenic carbon capture process may depend on the specific application and the type of cryogenic carbon capture technology used in the CCUS process. Ultimately, whether particular property is Class 57 Property will depend on its function within the CCUS process.

Additional equipment not listed may still be Class 57 Property and can include membranes as a common process in a hybrid cryogenic process. Refer to Section 3.3 for examples of hybrid membrane capture technologies.

NOTE: For keys to the process boundary notes on these schematics, as well as the other schematics in Section 3, please refer to Section 3.6. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
B-101	Boiler	Distillation Column Reboiler
C-101	Compressor	Refrigerant Compressor
E-101	Heat Exchanger	Treated Gas Recuperator HEX
E-102	Heat Exchanger	Contact Liquid Cooler HEX
E-103	Heat Exchanger	Refrigerant Condenser HEX
E-104	Heat Exchanger	Return Contact Liquid Chiller HEX
E-105	Heat Exchanger	Distillate CO_2 Condenser HEX
E-106	Heat Exchanger	Separated CO_2 Pre-Heater HEX
E-107	Heat Exchanger	Treated Gas Pre-Recuperator HEX
EX-101	Expander	Refrigerant Expansion Valve
P-101	Pump	Knock-Out Contact Liquid Pump
P-102	Pump	Rich Contact Liquid Pump
P-103	Pump	Separated CO_2 Pump
P-104	Pump	Reflux Return Pump
P-105	Pump	Reflux Top Product Pump
S-101	Vent Stack	Treated Gas Vent
T-101	Chemical Tank	Contact Liquid Storage Tank
V-101	Heat Exchanger Vessel	Desublimating HEX Tower
V-102	Gas-Liquid Separator	Contact Liquid Knock-Out
V-103	Distillation Column	CO_2 Distillation Column
V-104	Gas-Liquid Separator	Reflux Drum
V-105	Solid-Liquid Separator	Contact Liquid/CO_2 Separator

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Desublimation Tower Feed CO_2
4	Desublimation Tower Vent Gas
5	Cool Vent Gas
6	Warmed Vent Gas
7	Knock-Out Contact Liquid Return
8	Warmed Rich Contact Liquid
9	Warm Refrigerant
10	Compressed Refrigerant
11	Condensed Refrigerant
12	Cooled Refrigerant
13	Cooled Rich Contact Liquid
14	Contact Liquid Return
15	Separated CO_2
16	Warmed Disillation Feed CO_2
17	Contact Liquid Bottoms
18	Contact Liquid Bottoms Return
19	Contact Liquid Reboiler Slip-Stream
20	Steam Feed
21	Steam Condensate Return
22	Reboiled Contact Liquid
23	CO_2 Distillate
24	Condensed CO_2 Distillate
25	Distillation Column CO_2 Reflux
26	Captured CO_2
27	Compressed and Purified CO_2
28	Contact Liquid Fill Line
29	Contact Liquid Make-Up

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	Power and/or Heat and Water	Section 2.2
REF-04	CO_2 Compression and Purification	Section 2.3
REF-05	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

- CO_2
- Water
- Contact Liquid
- Steam
- Refrigerant
- Air

Class 57 Property for a External Cooling Loop Cryogenic Carbon Capture Process

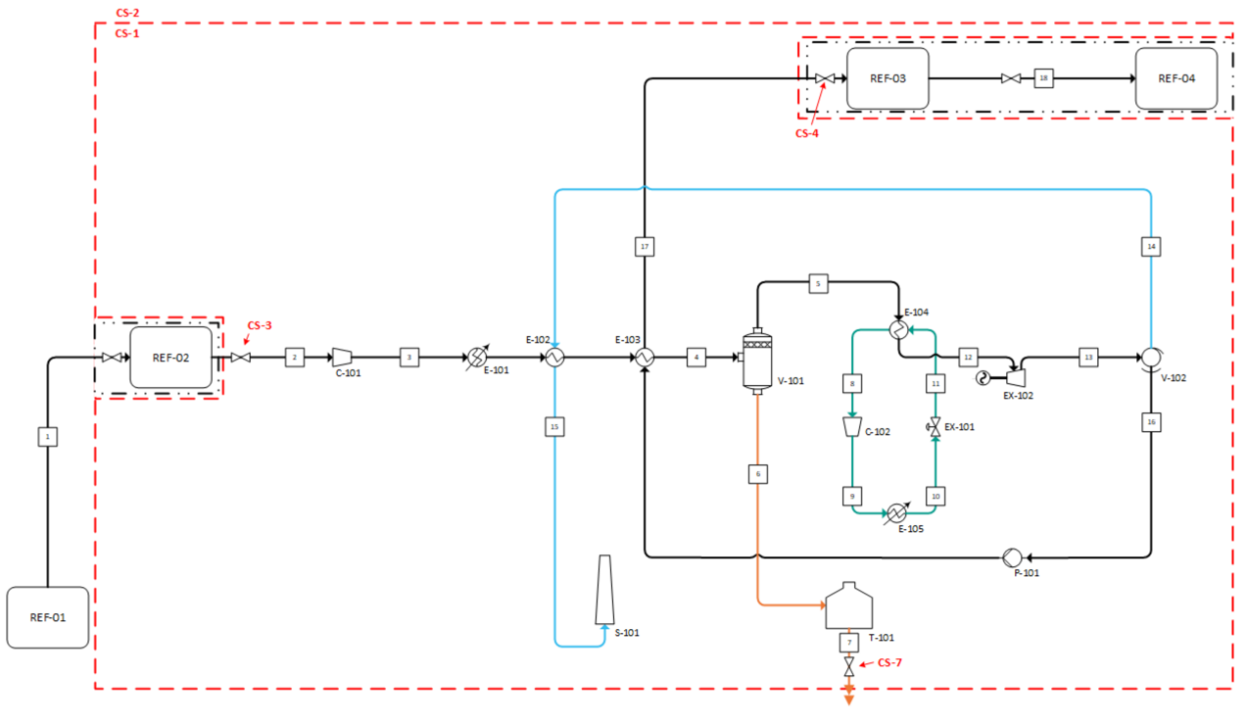
Other Class 57 Property or Class 58 Property

Other Class 57 Property or Dual-use Property

Figure 3.4-1: An example of external cooling loop cryogenic carbon capture process.

Figure Text Description: Diagram illustrating the boundaries of an external cooling loop cryogenic carbon capture process. The boundary begins at CS-3 (see section 3.6) after a raw CO_2 pre-treatment process, and includes equipment such as heat exchangers, compressors, boilers, pumps, and tanks. The boundary ends at CS-4 where a CO_2 purification and compression process begins. Boundaries on secondary streams needed for the equipment within the boundary for an external cooling loop cryogenic carbon capture process include CS-6 where contact liquid enters and CS-8 where water effluent and steam inlet streams which interact with the power and/or heat and water process boundary (section 2.2). For notes on process boundaries for this schematic and all other schematics in Section 3, please refer to Section 3.6, but not all notes apply to each schematic.

NOTE: For keys to the process boundary notes on these schematics, as well as the other schematics in Section 3, please refer to Section 3.6. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	Gas Compressor
C-102	Compressor	Refrigerant Compressor
E-101	Heat Exchanger	Compressed CO_2 Cooler HEX
E-102	Heat Exchanger	Vent Gas Heat Recovery HEX
E-103	Heat Exchanger	Separated CO_2 Heat Recovery HEX
E-104	Heat Exchanger	External Cooling HEX
E-105	Heat Exchanger	Refrigerant Condenser
EX-101	Expansion Valve	Refrigerant Expander
EX-102	Turbine	Desublimating Turbine
P-101	Pump	Solid CO_2 Pump
S-101	Vent Stack	Treated Gas Vent
T-101	Chemical Tank	Impurity Holding Tank
V-101	Gas-Liquid Separator	Impurity Knock-Out Drum
V-102	Solid-Gas Separator	Solid CO_2 Separator

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Compressed CO_2
4	Cooled Compressed CO_2
5	Purified CO_2
6	Liqufied Impurities
7	Impurity Removal
8	Warm Refrigerant
9	Compressed Refrigerant
10	Condensed Refrigerant
11	Cooled Refrigerant
12	Frost Point CO_2
13	Expanded CO_2
14	Cool Vent Gas
15	Warmed Vent Gas
16	Solid CO_2
17	Captured CO_2
18	Compressed and Purified CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Compression and Purification	Section 2.3
REF-04	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

- CO_2
- Refrigerant
- Air
- Impurities

Class 57 Property for a Compressed Gas Cryogenic Carbon Capture Process

Other Class 57 Property or Class 58 Property

Figure 3.4-2: An example of a compressed gas cryogenic carbon capture process.

Figure Text Description: Diagram illustrating the boundaries of a compressed gas cryogenic carbon capture process. The boundary begins at CS-3 (see section 3.6) after a raw CO_2 pre-treatment process, and includes equipment such as heat exchangers, compressors, boilers, pumps, and tanks. The boundary ends at CS-4 where a CO_2 purification and compression process begins. Boundaries on secondary streams needed for the equipment within the boundary for a compressed gas cryogenic carbon capture process include CS-7 for waste effluent stream which removes impurities from the system. For notes on process boundaries for this schematic and all other schematics in Section 3, please refer to Section 3.6, but not all notes apply to each schematic.

3.5 Calcium Looping Carbon Capture

3.5.1 Calcium Looping Carbon Capture Processes

Calcium looping capture processes use equipment featuring calcium looping technology to separate CO_2 for the purpose of capturing it.

Property that is part of a calcium looping carbon capture process, which is a subset of technology within carbon capture processes (described in Class 57 clause (a)(i)(A)), could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for capturing carbon dioxide that would otherwise be released into the atmosphere, is not oxygen production equipment, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
    - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

3.5.2 Pertinent Class 57 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process where calcium looping carbon capture is the primary technology will be based on the definitions set out in the Act and the Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 3.5.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, the following:

- carbonation vessel (e.g., fluidized bed reactor) that is to be used for facilitating the reaction between CO_2 and calcium oxide, including control systems to maintain fluidization and temperature (e.g., compressors, pumps, vessel jackets, internal coils, heat exchangers);

- calciner vessel (e.g., fluidized bed reactor, rotating kiln reactor) that is to be used for the purpose of facilitating the calcination reaction and release of CO_2. This vessel includes the burners and equipment required to maintain high process heat, as well as the control equipment to maintain fluidization or rotary action;
- heat exchanger equipment (e.g., condensing economizers, heat exchangers, glycol circulation equipment) that is to be used for heat recovery from the high temperature reactors and distribution within the CCUS process (e.g., air and fuel preheating);
- solid separation equipment (e.g., cyclones, filters, classifiers, baghouses) that is to be used for separating fine particulate from solid and gaseous streams within the CCUS process;
- mechanical fluid circulation equipment (e.g., blowers, fans, pumps) that is to be used for moving gaseous streams and fluids within the CCUS process;
- solid handling equipment (e.g., rotary conveyors, hoppers, chutes, bins) that is to be used for moving solid materials, such as calcium carbonate, through the CCUS process;
- tanks, pressure vessels, and bins for handling and holding materials that are to be used in the CCUS process; and
- any other property that is described in Class 57 in relation to a carbon capture process, including, but not limited to, ancillary equipment, monitoring and control equipment, and buildings or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

Certain property that supports a calcium looping carbon capture process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, may also be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates heat energy in support of a qualified CCUS project;
- generation equipment that generates electrical energy in support of a qualified CCUS project;
- generation equipment that generates a combination of electrical and heat energy in support of a qualified CCUS project;
- distribution equipment that distributes heat energy in support of a qualified CCUS project;
- distribution equipment that distributes electrical energy in support of a qualified CCUS project;
- transmission equipment that transmits electrical energy in support of a qualified CCUS project; and
- water use equipment that delivers, collects, recovers, treats, or recirculates water, or a combination of any of those activities, in support of a qualified CCUS project.

Raw CO_2 pre-treatment and CO_2 purification and compression processes are often integrated with carbon capture processes and certain property, described in Class 57 subparagraphs (a)(i)-(ii) of the Regulations, may be Class 57 Property. Please refer to Sections 2.1 and 2.3 for more information on Class 57 Property in the raw CO_2 pre-treatment and CO_2 purification and compression process, respectively.

3.5.3 Typical Property Not Included in Class 57

Property used in the calcium looping carbon capture process that is not Class 57 Property is ineligible for the CCUS Tax Credit. Examples of typical property not included in Class 57 include the following:

- equipment used in a calcium looping carbon capture process that is also used in a non-CCUS process (e.g., hydrogen production process, industrial process) and is therefore not used solely for a CCUS process, such as:
  - pre-treatment equipment (e.g., desulfurizers, SCRs, electrostatic precipitators, catalytic converters, filters, and similar equipment) that is used for removing impurities (e.g., H_2S, SO_x, NO_x, PM) from incoming raw CO_2 streams;
  - pre-treatment cooling equipment (e.g., DCCs, condensing economizers, intercoolers, condensers, cooling water heat exchangers, knock-out drums, dryers, and filters) that is used for cooling incoming raw CO_2 streams;
  - purge gas treatment equipment (e.g., wash water absorption vessels, fluid circulation equipment, cooling equipment, pressure swing adsorption equipment, and ancillary equipment) that is required for treating purge gas for use in a production-related process that is not a CCUS process;
- equipment that is used for removal of CO_2 or acid gas as part of natural gas processing;
- fuel processing, conditioning, and upgrading equipment and property, including monitoring and control equipment, building or other structures, and ancillary equipment; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note, this list is not exhaustive and is meant to provide general guidance on typical property used in a calcium looping carbon capture process that is not Class 57 Property.

3.5.4 Typical Capital Costs Included in Class 57

Typical capital costs when constructing a calcium looping carbon capture process that is part of a CCUS project would include the costs provided in Table 3.5-1:

Table 3.5-1 Project cost table for calcium looping carbon capture processes

Capital cost of Class 57 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. **These costs may be attributed to the following technical applications as part of a calcium looping carbon capture process, provided the property is Class 57 Property such as, but not limited to, the Class 57 Property described in Section** 3.5.2 **or Section** 1.5.1**:**	
1	Carbonation and calcination equipment
2	Solid handling and recirculation equipment, including particulate removal equipment
3	Heat exchange and cooling equipment

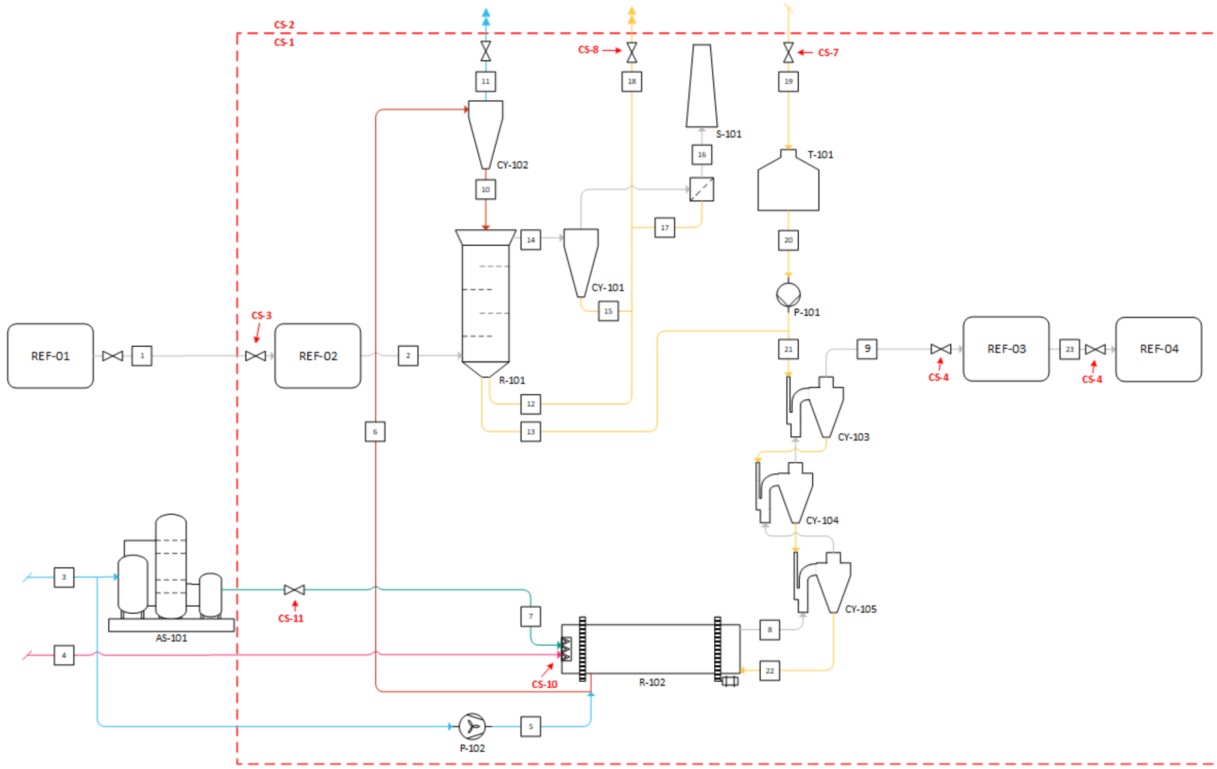
4	Mechanical fluid circulation equipment
5	Pre-treatment equipment – see Section 2.1 for details
6	CO_2 purification and compression equipment – see Section 2.2 for details
7	Heat generation equipment – see Section 2.2 for details
8	Heat distribution equipment – see Section 2.2 for details
9	Electricity generation equipment – see Section 2.2 for details
10	Electricity distribution equipment – see Section 2.2 for details
11	Electricity transmission equipment – see Section 2.2 for details
12	Process water stream delivery, collection, recovery, treatment, and recirculation equipment – see Section 2.2 for details
13	Electrical system equipment
14	Fuel supply system equipment
15	Liquid delivery and distribution equipment
16	Utility cooling system equipment
17	Material handling and storage and distribution system equipment, including holding tanks, conditioning equipment, and fluid transfer equipment
18	Venting system equipment
19	Process waste management system equipment
20	Compressed utility air or nitrogen system equipment
21	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
22	Process safety equipment
23	Flow control and containment equipment
24	Buildings or other structures
25	Equipment for conversion of existing property into Class 57 Property
26	Equipment for refurbishment of existing Class 57 Property

3.5.5 Schematic for Class 57 Property in Calcium Looping Carbon Capture Processes

Some typical elements of a CCUS process that can capture CO_2 using calcium looping technology are shown in the following schematic. Process boundaries defined here are for a typical calcium looping carbon capture process that is accompanied by a representative example.

However, note that the specific property that is used in a calcium looping carbon capture process may depend on the specific application and the type of calcium looping carbon capture technology used in the CCUS process. Ultimately, whether particular property is Class 57 Property will depend on its function within the CCUS process.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 3, please refer to Section 3.6. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
ASU-101	Air Separator	Air Separation Package
CY-101	Cyclone	Depleted CO_2 Purifying Cyclone
CY-102	Cyclone	CaO-Air Separation Cyclone
CY-103	Cyclone	$CaCO_3$ Preheat Cyclone 1
CY-104	Cyclone	$CaCO_3$ Preheat Cyclone 2
CY-105	Cyclone	$CaCO_3$ Preheat Cyclone 3
P-101	Solids Pump	Fresh $CaCO_3$ Injection Conveyor
P-102	Blower	CaO Carrier Air Blower
R-101	Reactor	Carbonation Reactor
R-102	Rotating Kiln	Rotary Calcination Reactor
S-101	Vent Stack	Depleted CO_2 Vent Stack
T-101	Chemical Tank	Fresh $CaCO_3$ Storage Tank

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Air
4	Natural Gas Kiln Feed
5	Calcium Oxide Carrier Air
6	Blown Calcium Oxide
7	Pure Oxygen Kiln Feed
8	Hot Treated CO_2
9	Treated CO_2
10	Calcium Oxide Carbonator Feed
11	Purged Air
12	Purge Calcium Carbonate
13	Recirculated Calcium Carbonate
14	Depleted CO_2
15	Particulate Calcium Carbonate Waste
16	Depleted CO_2 Purge
17	Calcium Carbonate Filter Waste
18	Calcium Carbonate Waste Purge
19	Fresh Calcium Carbonate Tank Loading
20	Fresh Calcium Carbonate Feed
21	Mixed Calcium Carbonate Feed
22	Heated Calcium Carbonate Kiln Feed
23	Compressed and Purified CO_2

Reference Identifier	Referenced Plant Section
REF-01	CO_2 Source Process
REF-02	Raw CO_2 Pre-Treatment
REF-03	CO_2 Compression and Purification
REF-04	CO_2 Transportation and Storage

Stream Legend

→ (grey)	CO_2
→ (pink)	Fuel
→ (red)	Calcium Oxide
→ (teal)	O_2
→ (blue)	Air
→ (yellow)	Calcium Carbonate

Figure 3.5-1: An example of a calcium looping carbon capture process.

Figure Text Description: Diagram illustrating the boundaries of a calcium looping carbon capture process. The boundary begins at CS-3 (see section 3.6) after a raw CO_2 pre-treatment process, and includes equipment such as cyclones, carbonation and calcination reactors, pumps, and tanks. The boundary ends at CS-4 where a CO_2 purification and compression process begins. Boundaries on secondary streams needed for the equipment within the boundary for a calcium looping carbon capture process includes CS-6 for calcium carbonate streams, CS-7 for waste streams, CS-9 for incoming fuel for a carbonation reactor, and CS-10 for oxygen's inlet. For notes on process boundaries for this schematic and all other schematics in Section 3, please refer to Section 3.6, but not all notes apply to each schematic.

3.6 Process Boundary Notes on Schematics of Carbon Capture Processes

A key to the process boundary notes on the schematics is provided here and includes the definition of process boundaries for typical carbon capture processes.

CS-1 For descriptions of the Class 57 Property included within this process boundary, see Section 3.1.2, 3.2.2, 3.3.2, 3.4.2, and 3.5.2 of this Guide.

CS-2 For descriptions of ineligible property that may be contained within this process boundary, see Section 3.1.3, 3.2.3, 3.3.3, 3.4.3, and 3.5.3 of this Guide.

CS-3 The CO_2 supply piping that is used by a carbon capture process is described in Class 57 clause (a)(i)(A) and the process boundary begins at, and includes, the first control valve that is used solely by property described in Class 57 clause (a)(i)(A). Where there is no control valve as described above, the process boundary for the carbon capture process is the point where the piping for the CO_2 supply system physically connects to the property described in Class 57 clause (a)(i)(A).

CS-4 The process boundary of the CO_2 piping system that is used by a carbon capture process begins at the point indicated by CS-3 and ends at the first control valve along the piping after property described in Class 57 clause (a)(i)(A), excluding the control valve itself.

CS-5 The water delivery, collection, recovery, treatment, and/or recirculation system, as part of a water use process that supports a carbon capture process, is described in Class 57 subparagraph (a)(v) or subparagraph (a)(ii) in the definition of dual-use equipment and is not within the carbon capture process boundary. The carbon capture process boundary related to the water use system begins at the point where the piping for the water use process physically connects to the property described in Class 57 clause (a)(i)(A).

CS-6 The process material storage and handling and distribution system, and the liquid delivery and distribution system, used by a carbon capture process is described in Class 57 paragraph (d) and includes piping and components that are used solely to carry solid, liquid, or gaseous materials from unloading areas to Class 57 Property. The carbon capture process boundary related to the material storage and handling and distribution system, and the liquid delivery and distribution system, begins at, and includes, the fitting that connects the piping to the delivery vessel or pipeline and includes all piping downstream, up to the point where the piping for the process material storage and handling and distribution system, or the liquid delivery and distribution system, physically connects to the property described in Class 57 clause (a)(i)(A). Where the material or liquid is not used solely by Class 57 Property, the process boundary related to the material storage and handling and distribution system, and liquid delivery and distribution system, begins at the point where the piping physically connects to the property described in Class 57 clause (a)(i)(A).

CS-7 The process waste management system used by a carbon capture process is described in Class 57 paragraph (d) and includes piping and components that are used solely to deliver waste streams coming from Class 57 Property to loading areas. The carbon capture process boundary related to the process waste management system begins at the point where the piping for the process waste management system physically connects to the property described in Class 57 clause (a)(i)(A) and includes all piping downstream, up to, and including, the last control valve before the point where the waste is removed from the plant boundary. If the whole piping system is used solely by Class 57 Property, all piping up to, and including, the fitting used to connect the system with a disposal vessel or pipeline is included in the process boundary.

CS-8 The heat distribution system that supports a carbon capture process is described in Class 57 subparagraph (a)(iii) or subparagraph (a)(iv) in the definition of dual-use equipment and is not within the carbon capture process boundary. The carbon capture process boundary related to the heat distribution process begins at the point where the piping for the heat distribution process physically connects to the property described in Class 57 clause (a)(i)(A).

CS-9 The fuel supply system used by a carbon capture process is described in Class 57 paragraph (d) and includes piping and components used solely to deliver fuel to Class 57 Property. The carbon capture process boundary related to the fuel supply system begins at, and includes, the first control valve along the piping that is used solely by Class 57 Property and includes all piping up to the point where the piping physically connects to the property described in Class 57 clause (a)(i)(A).

CS-10 The oxygen supply line used by a carbon capture process is described in Class 57 paragraph (d) and includes piping and components that are necessary to deliver oxygen to Class 57 Property. The carbon capture process boundary related to the oxygen supply system begins at, and includes, the first control valve along the piping system that is used solely by Class 57 Property and includes all piping up to the point where the piping physically connects to the property described in Class 57 clause (a)(i)(A). Where there is no control valve as described above, the carbon capture process boundary related to the oxygen supply system is the point where the piping physically connects to the property described in Class 57 clause (a)(i)(A).

3.6.1 Class 57 Property Not Shown on the Schematic of Carbon Capture Processes

There are other property and systems ancillary to carbon capture processes that are not explicitly shown in the schematic but are still part of the CCUS process.

- The cooling system used by a carbon capture process is described in Class 57 paragraph (d) and includes piping and components that are used solely to deliver cooling fluid (e.g., cooling water, air, glycol) to and from the Class 57 Property. The carbon capture process boundary related to the cooling system begins at, and includes, the first control valve along the piping or ducting system that is used solely by the Class 57 Property and includes all piping or ducting downstream, up to and including the last control valve along the piping or ducting system that is used solely by the Class 57 Property. These points are located before and after the property described in Class 57 clause (a)(i)(A). If the whole cooling system is used solely by Class 57 Property, all piping and components are within the process boundaries of these processes. Otherwise, the carbon capture process boundary related to the cooling systems is the point where the piping for the cooling system physically connects to the property described in Class 57 subparagraph (a)(i)(A).

- The utility air or nitrogen distribution system used by a carbon capture process is described in Class 57 paragraph (d) and includes piping and components that are used solely to supply utility air or nitrogen for the operation of equipment (e.g., pneumatic) and control systems (e.g., actuators) that is Class 57 Property. The carbon capture process boundary related to the utility air or nitrogen distribution system begins at, and includes, the first control valve along the piping system that is used solely by the Class 57 Property and includes all piping downstream, up to the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 57 clause (a)(i)(A). Otherwise, the carbon capture process boundary related to the utility air or nitrogen distribution system is the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 57 clause (a)(i)(A).
- The electrical system used by a carbon capture process is described in Class 57 paragraph (d) and includes wiring and components that are used solely to supply electrical energy for the operation of equipment that is Class 57 Property. The carbon capture process boundary related to the electrical system begins at, and includes, the first isolation switch along the wiring system that is used solely by the Class 57 Property and includes all wiring downstream, up to the point where the wiring for the electrical system physically connects to the property described in Class 57 clause (a)(i)(A). Otherwise, the carbon capture process boundary related to the electrical system is the point where the wiring for the electrical system physically connects to the property described in Class 57 clause (a)(i)(A).
- The power distribution system that supports a carbon capture process is described in Class 57 subparagraph (a)(iii) or subparagraph (a)(iv) in the definition of dual-use equipment and is not within the carbon capture process boundary. The carbon capture process boundary related to the power distribution system begins at the point where the power lines for the power distribution system physically connect to the property described in Class 57 clause (a)(i)(A).

4 Direct Air Capture Processes

4.1 Direct Air Capture

4.1.1 Direct Air Capture Processes

Direct air capture processes use equipment featuring direct air capture (DAC) technology to separate CO_2 from ambient air for the purpose of capturing it.

Property that is part of a direct air capture process, which is a subset of technology within carbon capture processes (described in Class 57 clause (a)(i)(B)), could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for capturing carbon dioxide directly from the ambient air, is not oxygen production equipment, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
    - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

4.1.2 Pertinent Class 57 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process where DAC is the primary technology will be based on the definitions set out in the Act and the Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 4.1.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Typical direct air capture processes include, but are not limited to, chemical-based processes such as high temperature liquid solvent and low temperature solid sorbent processes. Rather, these processes represent prominent technologies and are described in this Guide. Examples of Class 57 Property could include, but are not limited to, the following:

- liquid solvent CO_2 capture equipment (e.g., contactor arrays, air contactor basins) that is to be used for separating CO_2 from ambient air by absorption in a liquid solvent, including equipment that ensures continuous operation of the absorption/regeneration cycles (e.g., demisters, structured packings, fibre-reinforced plastic structural components) and absorbers for capturing exhaust CO_2 from a power generation system that drives the direct air capture process;

- chemical reactors and processing equipment (e.g., pellet reactors/causticizers, slakers, calciners) that are to be used for releasing CO_2 from the CO_2/liquid solvent stream, and regeneration of reagents for re-use and continuous operation of the absorption and desorption/regeneration cycles, as well as equipment for pressurization and depressurization;
- solid adsorbent CO_2 adsorption/desorption equipment (e.g., collectors, air contactors, filter materials, strippers) that is to be used for separating CO_2 from ambient air, including equipment for circulating air (e.g., fans) and releasing the CO_2 from the solid adsorbent using either PSA, TSA, or humidity swing adsorption, including equipment for evacuating oxygen trapped in the adsorption channel/tube (e.g., vacuum pumps) and equipment for heating to regenerate the adsorbent for re-use. See Section 3.2 for more details on PSA and TSA technologies;
- heat recovery equipment (e.g., heat recovery steam generators, cooling water heat exchangers, cyclone preheaters, superheaters) that is to be used for regulating the temperature of the solvent/sorbent and reagents to facilitate absorption and stripping of CO_2 from the solvent, and for heat recovery for use within the CCUS process;
- cooling equipment (e.g., condensers, intercoolers, lime coolers) that is to be used for cooling the sorbent/solvent to avoid degeneration and for the operation of the CCUS process;
- separation and fluid recovery equipment (e.g., clarificators, separators, filters, filter presses, water knockouts, drain drums, dryers) that is to be used for isolating and regenerating the solvent, reagent, water, and capture agent for re-use in the CCUS process;
- mechanical circulation equipment (e.g., blowers, fans, vacuum pumps, pumps) that is to be used for moving gaseous, liquid, and solid streams and fluids through the CCUS process;
- tanks for handling materials that are to be used for the CCUS process, including mixing and make-up tanks and equipment that is used to maintain the chemicals at the necessary storage conditions; and
- any other property that is described in Class 57 in relation to a direct air capture process, including, but not limited to, ancillary equipment, monitoring and control equipment, and building or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

Certain property that supports a direct air capture process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, may also be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates heat energy in support of a qualified CCUS project;
- generation equipment that generates electrical energy in support of a qualified CCUS project;
- generation equipment that generates a combination of electrical and heat energy in support of a qualified CCUS project;
- distribution equipment that distributes heat energy in support of a qualified CCUS project;
- distribution equipment that distributes electrical energy in support of a qualified CCUS project;
- transmission equipment that transmits electrical energy in support of a qualified CCUS project; and

- water use equipment that delivers, collects, recovers, treats, or recirculates water, or a combination of any of those activities, in support of a qualified CCUS project.

CO_2 purification and compression processes are often integrated with direct air capture processes and certain property, described in Class 57 subparagraph (a)(ii) of the Regulations, may be Class 57 Property. Please refer to Section 2.3 for more information on Class 57 Property in the CO_2 purification and compression process.

4.1.3 Typical Property Not Included in Class 57

Property used in the direct air capture process that is not Class 57 Property is ineligible for the CCUS Tax Credit. Examples of typical property not included in Class 57 include the following:

- equipment that is used in a DAC process that is also used in a non-CCUS process (e.g., hydrogen production process, industrial process) and is therefore not used solely for a CCUS process, such as:
  - purge gas treatment equipment (e.g., wash water absorption vessels, fluid circulation equipment, cooling equipment, pressure swing adsorption equipment, and ancillary equipment) that is required for treating purge gas for use in a production-related process that is not a CCUS process;
- fuel processing, conditioning, and upgrading equipment and property, including monitoring and control equipment, building or other structures, and ancillary equipment; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note that this list is not exhaustive and is meant to provide general guidance on property used commonly in a direct air capture process that is not Class 57 Property.

4.1.4 Typical Capital Costs Included in Class 57

Typical capital costs when constructing a direct air capture process that is part of a CCUS project would include the costs provided in Table 4.1-1:

Table 4.1-1 Project cost table for direct air capture processes

Capital cost of Class 57 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. **These costs may be attributed to the following technical applications as part of a direct air capture process, provided the property is Class 57 Property such as, but not limited to, the Class 57 Property described in Section** 4.1.2 **or Section** 1.5.1**:**	
1	Liquid solvent, solid sorbent adsorption/desorption, and other carbon capture equipment
2	Chemical reactors and process equipment, including pressurization/depressurization equipment
3	Fluid separation and recovery equipment

4	Heat recovery and cooling equipment
5	Mechanical fluid circulation equipment
6	Pre-treatment equipment – see Section 2.1 for details
7	CO_2 purification and compression equipment – see Section 2.2 for details
8	Heat generation equipment – see Section 2.2 for details
9	Heat distribution equipment – see Section 2.2 for details
10	Electricity generation equipment – see Section 2.2 for details
11	Electricity distribution equipment – see Section 2.2 for details
12	Electricity transmission equipment – see Section 2.2 for details
13	Process water stream delivery, collection, recovery, treatment, and recirculation equipment – see Section 2.2 for details
14	Electrical system equipment
15	Fuel supply system equipment
16	Liquid delivery and distribution equipment
17	Utility cooling system equipment
18	Material handling and storage and distribution system equipment, including holding tanks, conditioning equipment, and fluid transfer equipment
19	Venting system equipment
20	Process waste management system equipment
21	Compressed utility air or nitrogen system equipment
22	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
23	Process safety equipment
24	Flow control and containment equipment
25	Buildings or other structures
26	Equipment for conversion of existing property into Class 57 Property
27	Equipment for refurbishment of existing Class 57 Property

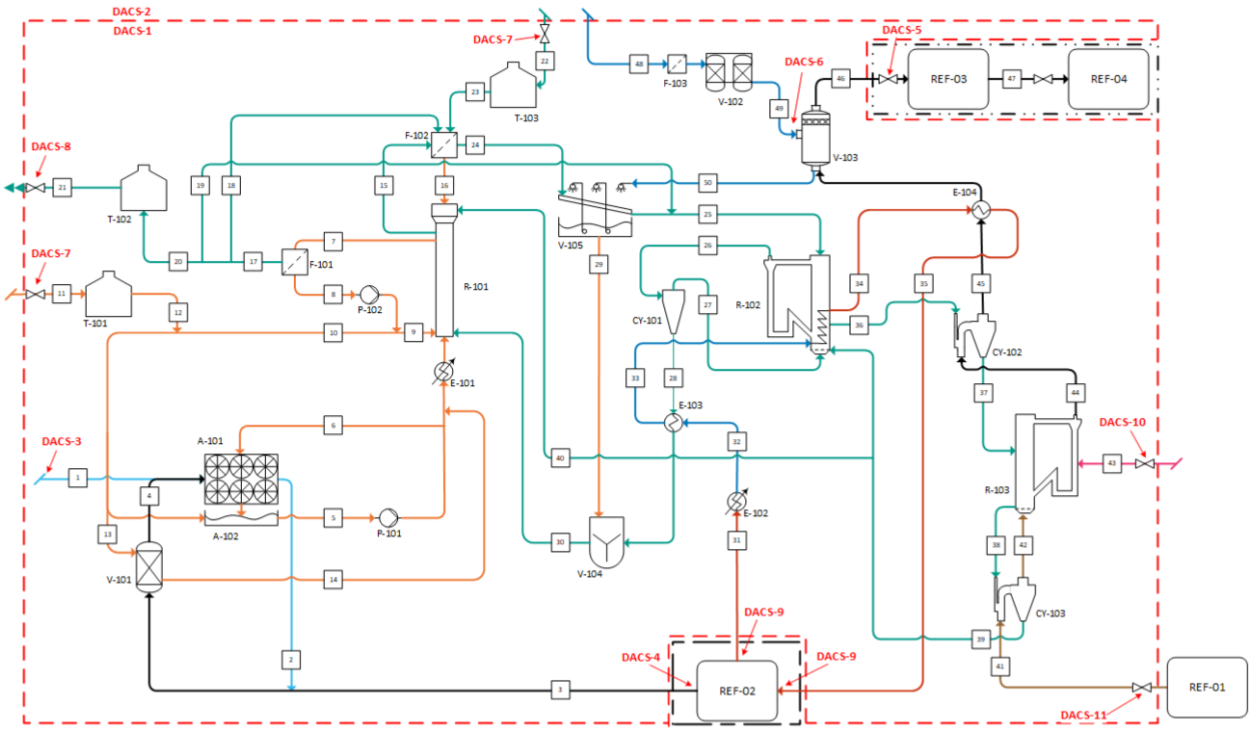
4.1.5 Schematics for Class 57 Property in Direct Air Capture Processes

Some typical elements of a CCUS process that can capture CO_2 using DAC are shown in Figure 4.1-1 and Figure 4.1-2. Process boundaries defined here are for typical direct air capture processes, using schematics of a liquid solvent direct air capture process and a solid adsorbent direct air capture process, respectively, as representative examples.

However, note that the specific property that is used in a direct air capture process may depend on the specific application and the type of solvent/sorbent used in the CCUS process. Ultimately, whether particular property is Class 57 Property will depend on its function within the CCUS process.

Additional equipment not listed may still be Class 57 Property and can include fixed, moving, or circulating fluidized bed reactors and other types of DAC processes (e.g., moisture/humidity, electro-, and other swing adsorption). Typical solid sorbents that may be used in direct air capture processes include MOFs, zeolites, activated carbon, silica materials, carbon nanotubes, porous organic polymers, and carbon molecular sieves. Typical liquid solvents that may be used are aqueous basic solutions (e.g., KOH, NaOH) and aqueous amino acid solutions (e.g., glycine, sarcosine).

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematic in Section 4, please refer to Section 4.2. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
A-101	Air Contactor	Air Contactor
A-102	Air Contactor	Air Contactor Basin
CY-101	Cyclone	Fine Slaked Metal Oxide Collector
CY-102	Cyclone	Heat Recovery Cyclone
CY-103	Cyclone	Heat Recovery Cyclone
E-101	Heat Exchanger	Caustic Solution Cooling Water HEX
E-102	Heat Exchanger	Steam Cooling Water HEX
E-103	Heat Exchanger	Hydrated Metal Oxide Heat Recovery HEX
E-104	Heat Exchanger	Steam Superheating HEX
F-101	Filter	Carbonate Fines Filter
F-102	Filter	Carbonate Pellets Filter
F-103	Filter	Activated Carbon Water Filter
P-101	Pump	Caustic Solution Pump
P-102	Pump	Caustic Solution Return Oump
R-101	Reactor	Fluidized Bed Reactor
R-102	Reactor	Steam Slaker
R-103	Reactor	Calciner
T-101	Chemical Tank	Caustic Solution Make-up Tank
T-102	Chemical Tank	Carbonate Fines Tank
T-103	Chemical Tank	Carbonate Make-up Tank
V-101	Packed Column	CO_2 Stripping Column
V-102	Fixed Bed Vessel	Ion Exchange System
V-103	Gas-Liquid Separator	Water Knock-Out Drum
V-104	Mixing Tank	Metal Oxide Mixing Tank
V-105	Washer	Carbonate Pellet Washer

Stream Number	Stream Type
1	Air
2	CO_2-Depleted Air
3	Flue Gas
4	CO_2 Absorber Flue Gas
5	CO_2-Rich Caustic Solution
6	Air Contactor Caustic Solution Reflux
7	Pellet Reactor Carbonate Fines
8	Filtered Caustic Solution
9	Pellet Reactor Caustic Solution Return
10	Air Contactor Caustic Solution Return
11	Caustic Solution Tank Fill Line
12	Caustic Solution Make-up
13	CO_2 Absorber Slip Stream
14	CO_2 Absorber CO_2-Rich Caustic Solution
15	Pellet Reactor Carbonate Pellets
16	Pellet Separator Caustic Solution Return
17	Filtered Carbonate Fines
18	Pellet Reactor Carbonate Seeds
19	Carbonate Fines to Calciner
20	Carbonate Fines to Disposal Tank
21	Carbonate Fines Removal
22	Carbonate Tank Fill Line
23	Carbonate Make-up
24	Carbonate Pellets to Washer
25	Wet Carbonate Pellets
26	Fine Slaked Metal Oxide
27	Recirculated Metal Oxide
28	Hydrated Metal Oxide
29	Washer Caustic Solution Return
30	Hydrated Metal Oxide Caustic Solution
31	Steam Turbine Outlet Steam
32	Condensate
33	Steam Slaker Water Inlet
34	Steam Slaker Steam Outlet
35	Superheated Steam
36	Dry Carbonate Pellets

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	Air Separation Unit	Section 5.2
REF-02	Power and/or Heat and Water	Section 2.2
REF-03	CO_2 Compression and Purification	Section 2.3
REF-04	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

- CO_2
- Water
- Caustic Solution
- Fuel
- Steam
- O_2
- Air
- Carbonate

Class 57 Property for a Liquid Solvent Direct Air Carbon Capture Process

Other Class 57 Property or Class 58 Property

Other Class 57 Property or Dual-use Property

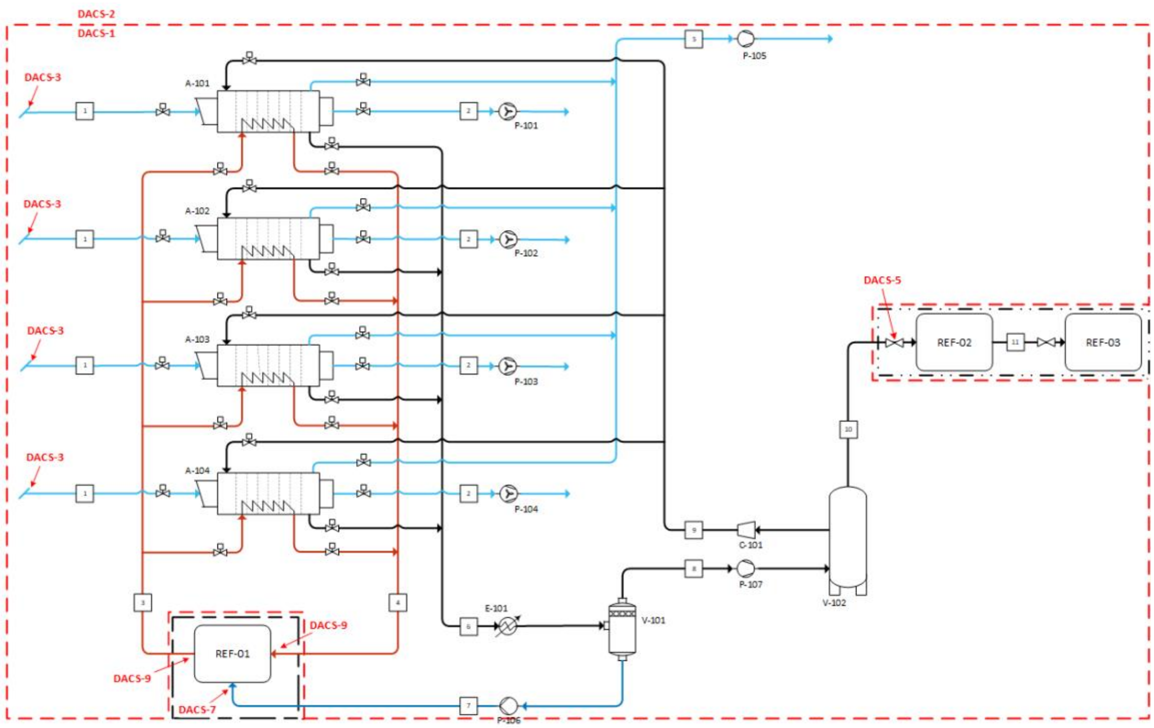
37	Pre-Heated Carbonate Pellets
38	Regenerated Metal Oxide
39	Steam Slaker Metal Oxide Inlet
40	Pellet Reactor Carbonate Seed Return
41	Oxygen Feed
42	Pre-Heated Oxygen
43	Fuel Feed
44	Wet Calciner CO_2 Top Product
45	Cooled Wet CO_2 Top Product
46	Captured CO_2
47	Compressed and Purified CO_2
48	Raw Water Inlet
49	Water Feed
50	Knock-Out Water Return

Figure 4.1-1: An example of a liquid solvent direct air capture process.

Figure Text Description: Diagram illustrating the boundaries of a liquid solvent DAC process. The boundary begins at DACS-3 where ambient air is brought to the process, and includes equipment such as air contactors, cyclones, heat exchangers, filters, pumps, reactors, and tanks. The boundary ends at

DACS-5 where a CO_2 purification and compression process begins. Boundaries on secondary streams needed for the equipment within the boundary for a liquid solvent DAC process include DACS-4 for CO_2 streams from heat and electricity systems, DACS-6 for water steams, DACS-9 for steam, DACS-7 for carbonate streams, DACS-8 for waste streams, DACS-7 for caustic streams, DACS-110 for fuel streams, and DACS-11 for oxygen. For notes on process boundaries for this schematic and all other schematics in Section 4, please refer to Section 4.2, but not all notes apply to each schematic.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematic in Section 4, please refer to Section 4.2. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
A-101	Contactor	Adsorbent Bed Air Contactor
A-102	Contactor	Adsorbent Bed Air Contactor
A-103	Contactor	Adsorbent Bed Air Contactor
A-104	Contactor	Adsorbent Bed Air Contactor
C-101	Compressor	CO_2 Purge Compressor
E-101	Heat Exchanger	Desorbed CO_2 HEX
P-101	Blower	Air Contactor Ventilator
P-102	Blower	Air Contactor Ventilator
P-103	Blower	Air Contactor Ventilator
P-104	Blower	Air Contactor Ventilator
P-105	Vacuum Pump	Residual Air Vacuum Pump
P-106	Pump	Condensed Water Return Pump
P-107	Vacuum Pump	CO_2 Vacuum Pump
V-101	Gas-Liquid Separator	Water Knock-Out Drum
V-102	Pressure Vessel	CO_2 Product Storage Tank

Stream Number	Stream Type
1	Air
2	CO_2-Depleted Air
3	Steam Feed
4	Steam Return
5	Residual Air
6	Treated CO_2
7	Knock-Out Water Return
8	De-watered CO_2
9	CO_2 Purge Line
10	Captured CO_2
11	Compressed and Purified CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	Power and/or Heat and Water	--
REF-02	CO_2 Compression and Purification	Section 2.3
REF-03	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

CO_2
Air
Water
Steam

Class 57 Property for a Solid Adsorption Direct Air Carbon Capture Process

Other Class 57 Property or Class 58 Property

Other Class 57 Property or Dual-use Property

Figure 4.1-2: An example of a solid adsorbent direct air capture process.

Figure Text Description: Diagram illustrating the boundaries of a solid adsorbent DAC process. The boundary begins at DACS-3 where ambient air is brought to the process, and includes equipment such as air contactors, heat exchangers, blowers, and pumps. The boundary ends at DACS-5 where a CO_2 purification and compression process begins. Boundaries on secondary streams needed for the equipment within the boundary for a solid adsorbent DAC process include DACS-9 for steam, and DACS-7 for water effluent. For notes on process boundaries for this schematic and all other schematics in Section 4, please refer to Section 4.2, but not all notes apply to each schematic.

4.2 Process Boundary Notes on Schematics of Direct Air Capture Processes

A key to the process boundary notes on the schematics is provided here and includes the definition of process boundaries for typical direct air capture processes.

DACS-1 For descriptions of the Class 57 Property included within this process boundary, see Section 4.1.2 of this Guide.

DACS-2 For descriptions of ineligible property that may be contained within this process boundary, see Section 4.1.3 of this Guide.

DACS-3 The ambient air supply piping system that is used by a direct air capture process is described in Class 57 clause (a)(i)(B) and the process boundary begins at, and includes, the first control valve that is used solely by property described in Class 57 clause (a)(i)(B). Where there is no control valve as described above, the process boundary for the direct air capture process is the point where the piping for the ambient air supply system physically connects to the property described in Class 57 clause (a)(i)(B).

DACS-4 The flue gas piping system that is used by a direct air capture process is described in Class 57 clause (a)(i)(B) and the process boundary begins at the point where the piping for the flue gas piping system physically connects to the property described in Class 57 clause (a)(iii) or subparagraph (a)(i) in the definition of dual-use equipment. Where there is no control valve as described above, the direct air capture process boundary begins at the point where the piping for the heat and/or power generation process physically connects to the property described in Class 57 clause (a)(i)(B).

DACS-5 The process boundary of the CO_2 piping system that is used by a direct air capture process begins at the point indicated by DACS-3 and ends at the first control valve along the piping after property described in Class 57 clause (a)(i)(B), excluding the control valve itself.

DACS-6 The water delivery, collection, recovery, treatment, and/or recirculation system, as part of a water use process that supports a direct air capture process, is described in Class 57 subparagraph (a)(v) or subparagraph (a)(ii) in the definition of dual-use equipment and is not within the direct air capture process boundary. The direct air capture process boundary related to the water use system begins at the point where the piping for the water use process physically connects to the property described in Class 57 clause (a)(i)(B).

DACS-7 The process material storage and handling and distribution system, and the liquid delivery and distribution system, used solely by a direct air capture process is described in Class 57 paragraph (d) and includes piping and components that are used solely to carry solid, liquid, or gaseous materials from unloading areas to Class 57 Property. The direct air capture process boundary related to the material storage and handling and distribution system, and the liquid delivery and distribution system, begins at, and includes, the fitting that connects the piping to the delivery vessel or pipeline and includes all piping downstream, up to the point where the piping for the process material storage and handling and distribution system, or the liquid delivery and distribution system, physically connects to the property described in Class 57 clause (a)(i)(B). Where the material or liquid is not used solely by Class 57 Property, the process boundary related to the material storage and handling and distribution system, and liquid delivery and distribution system, begins at the point where the piping physically connects to the property described in Class 57 clause (a)(i)(B).

DACS-8 The process waste management system used by a direct air capture process is described in Class 57 paragraph (d) and includes piping and components that are used solely to deliver waste streams coming from Class 57 Property to loading areas. The direct air capture process boundary related to the process waste management system begins at the point where the piping for the process waste management system physically connects to the property described in Class 57 clause (a)(i)(B) and includes all piping downstream, up to, and including, the last control valve before the point where the waste is removed from the plant boundary. If the whole piping system is used solely by Class 57 Property, all piping up to, and including, the fitting used to connect the system with a disposal vessel or pipeline is included in the process boundary.

DACS-9 The heat distribution system that supports a direct air capture process is described in Class 57 subparagraph (a)(iii) or subparagraph (a)(iv) in the definition of dual-use equipment and is not within the direct air capture process boundary. The direct air capture process boundary related to the heat distribution process begins at the point where the piping for the heat distribution process physically connects to the property described in Class 57 clause (a)(i)(B).

DACS-10 The fuel supply system used by a direct air capture process is described in Class 57 paragraph (d) and includes piping and components used solely to deliver fuel to Class 57 Property. The direct air capture process boundary related to the fuel supply system begins at, and includes, the first control valve along the piping that is used solely by Class 57 Property and includes all piping up to the point where the piping physically connects to the property described in Class 57 clause (a)(i)(B).

DACS-11 The oxygen supply line used by a direct air capture process is described in Class 57 paragraph (d) and includes piping and components that are necessary to deliver oxygen to Class 57 Property. The direct air capture process boundary related to the oxygen supply system begins at, and includes, the first control valve along the piping system that is used solely by Class 57 Property and includes all piping up to the point where the piping physically connects to the property described in Class 57 clause (a)(i)(B). Where there is no control valve as described above, the direct air capture process boundary related to the oxygen supply system is the point where the piping physically connects to the property described in Class 57 clause (a)(i)(B).

4.2.1 Class 57 Property Not Shown on the Schematics of Direct Air Capture Processes

There are other property and systems ancillary to direct air capture processes that are not explicitly shown in the schematics but are still part of the CCUS process.

- The cooling system used by a direct air capture process is described in Class 57 paragraph (d) and includes piping and components that are used solely to deliver cooling fluid (e.g., cooling water, air, glycol) to and from the Class 57 Property. The direct air capture process boundary related to the cooling system begins at, and includes, the first control valve along the piping or ducting system that is used solely by the Class 57 Property and includes all piping or ducting downstream, up to and including the last control valve along the piping or ducting system that is used solely by the Class 57 Property. These points are located before and after the property described in Class 57 clause (a)(i)(B). If the whole cooling system is used solely by Class 57 Property, all piping and components are within the process boundaries of these processes. Otherwise, the direct air capture process boundary related to the cooling systems is the point where the piping for the cooling system physically connects to the property described in Class 57 subparagraph (a)(i)(B).
- The utility air or nitrogen distribution system used by a direct air capture process is described in Class 57 paragraph (d) and includes piping and components that are used solely to supply utility air or nitrogen for the operation of equipment (e.g., pneumatic) and control systems (e.g., actuators) that is Class 57 Property. The direct air capture process boundary related to the utility air or nitrogen distribution system begins at, and includes, the first control valve along the piping system that is used solely by the Class 57 Property and includes all piping downstream, up to the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 57 clause (a)(i)(B). Otherwise, the direct air capture process boundary related to the utility air or nitrogen distribution system is the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 57 clause (a)(i)(B).
- The electrical system used by a direct air capture process is described in Class 57 paragraph (d) and includes wiring and components that are used solely to supply electrical energy for the operation of equipment that is Class 57 Property. The direct air capture process boundary related to the electrical system begins at, and includes, the first isolation switch along the wiring system that is used solely by the Class 57 Property and includes all wiring downstream, up to the point where the wiring for the electrical system physically connects to the property described in Class 57 clause (a)(i)(B). Otherwise, the direct air capture process boundary related to the electrical system is the point where the wiring for the electrical system physically connects to the property described in Class 57 clause (a)(i)(B).
- The power distribution system that supports a direct air capture process is described in Class 57 subparagraph (a)(iii) or subparagraph (a)(iv) in the definition of dual-use equipment and is not within the direct air capture process boundary. The direct air capture process boundary related to the power distribution system begins at the point where the power lines for the power distribution system physically connect to the property described in Class 57 clause (a)(i)(B).

5 Carbon Capture Processes with Ineligible Property

5.1 Hydrogen Production

5.1.1 Carbon Capture from Hydrogen Production

Property that is required for hydrogen production (described in Class 57 paragraph (a)) is excluded from Class 57 equipment and is therefore not Class 57 Property.

However, property that separates CO_2 from specific process streams resulting from hydrogen production, which is a subset of technology within carbon capture processes (described in Class 57 clause (a)(i)(A)) may be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for capturing carbon dioxide that would otherwise be released into the atmosphere, is not oxygen production equipment, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
    - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

5.1.2 Pertinent Class 57 Property

Although property that is expected to be used for hydrogen production is excluded from Class 57, property described in Class 57 subparagraph (a)(i)(A) that is used solely for capturing carbon dioxide that results from hydrogen production may be eligible for the CCUS tax credit.

Whether a particular property is considered to be used solely to capture carbon dioxide, or is expected to be used for hydrogen production, depends on specific process conditions and configurations. Such a determination is made following a review of all the relevant process flow diagrams and related information and circumstances relating to a particular situation.

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process that captures carbon dioxide from hydrogen production will be based on the definitions set out in the Act and Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 5.1.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, property found in other sections of this Guide.

The purpose of this Section is to explicitly describe the process boundary between the Class 57 Property and ineligible property that is required for hydrogen production.

5.1.3 Typical Property Not Included in Class 57

Ineligible property within a process that captures carbon dioxide from hydrogen production includes, but is not limited to, the following:

- equipment for methane reforming through methods such as Steam Methane Reforming (SMR), Autothermal Reforming (ATR), Dry Reforming of Methane (DRM), Tri-reforming of Methane (TRM), and analogous reforming technologies that make use of thermochemical or catalytic conversion of hydrocarbon feedstock to produce hydrogen (e.g. reforming reactors, combustion chambers, burner control systems and instrumentation, fuel processing or conditioning and supply infrastructure, heat recovery units, air supply, water gas shift reactors, catalytic reformers);
- oxygen production equipment such as air separation units that provide oxygen for the production of hydrogen from natural gas;
- equipment for chemical or calcium looping process integration with the production of hydrogen or synthesis gas from hydrocarbon feedstock (fuel reactors, transport medium regenerators, solid transport and separation equipment, control systems and instrumentation);
- equipment for the pyrolysis or gasification of hydrocarbon feedstocks to produce hydrogen, fuels, and materials such as biochar or solid carbon (e.g., pyrolysis/gasification chambers, high voltage electrical supply, plasma chambers, solid material separation and handling, water gas shift reactors, biomass harvesting and processing equipment); and
- equipment meant to treat or purify hydrogen or other production gases (e.g., fuel gas, synthesis gas, purge gas or tail gas) or to supply required feedstocks to such systems (e.g., CO_2/H_2 PSA equipment, compressors, vacuum pumps) and any equipment that is integrated into, but not used solely for, the CCUS process.

5.1.4 Schematics for Class 57 Property for Carbon Capture from Hydrogen Production

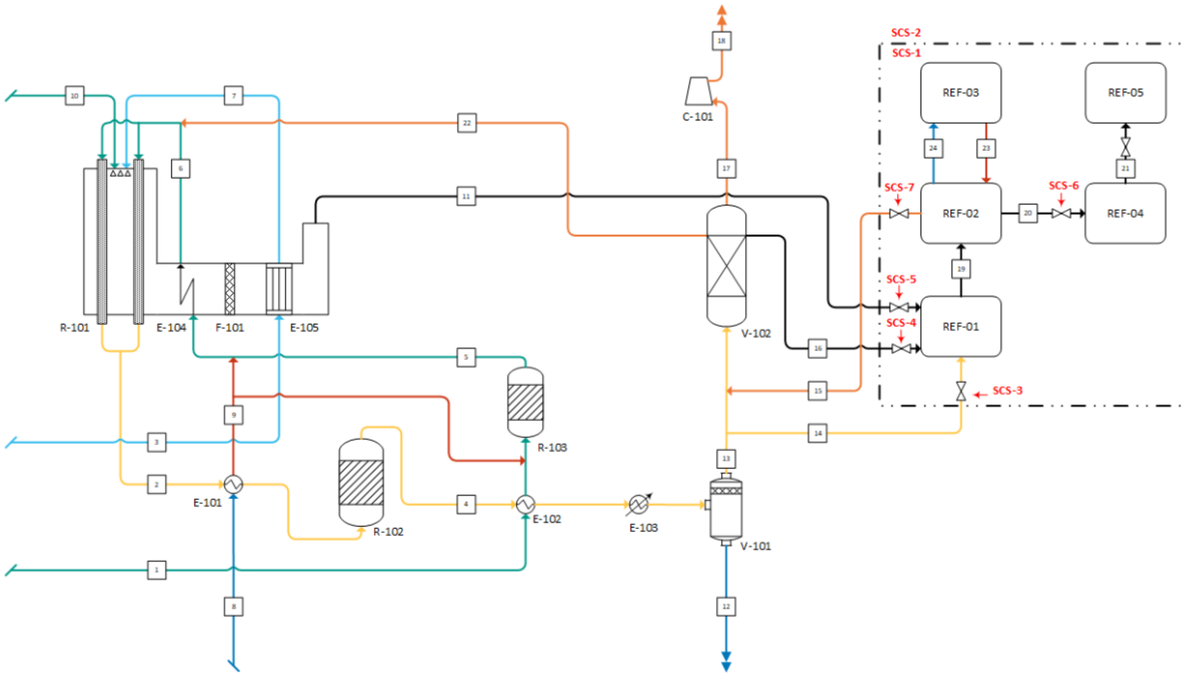
Schematics demarcating the process boundaries of generic carbon capture processes implemented on SMR and ATR hydrogen production processes are shown as representative examples in Figure 5.1-1 and Figure 5.1-2, respectively.

In the case of capture from SMR and ATR hydrogen production, three possible configurations, and their applicable process boundaries, are shown for a raw CO_2 stream entering the carbon capture process.

For SMR hydrogen production, these configurations are given for capture from a dehydrated H_2-CO_2 stream (Stream #14), pressure swing vessel tail gas (Stream #16), and SMR flue gas (Stream #11) and are indicated in Figure 5.1-1 by the labels SCS-3, SCS-4, and SCS-5, respectively. For ATR hydrogen production, these configurations are given for capture from a dehydrated H_2-CO_2 stream (Stream #13), pressure swing vessel tail gas (Stream #15), and SMR flue gas (Stream #10) and are indicated in Figure 5.1-2 by the labels SCS-3, SCS-4, and SCS-5, respectively. In practice it is unlikely that all configurations are used, but they are shown here for the purpose of this schematic. For SMR hydrogen production, a pure H_2 return stream (Stream #15) is also indicated in Figure 5.1-1 by SCS-7 and would be present in configurations capturing from a H_2-CO_2 stream (Stream #14) or a pressure swing vessel tail gas stream (Stream #16). For ATR hydrogen production, a pure H_2 return stream (Stream #14) is also indicated in Figure 5.1-2 by SCS-7 and would be present in configurations capturing from a H_2-CO_2 stream (Stream #13) or a pressure swing vessel tail gas stream (Stream #15).

Note that equipment may differ between existing or proposed SMR or ATR processes and the equipment depicted in these schematics. Other hydrogen production processes with carbon capture processes will have similar process boundaries. In the case of these processes, gas that enters the carbon capture process is permitted to have some hydrogen content, but any property that is used for further processing of the hydrogen stream that is additional to CO_2 separation is not Class 57 Property. Furthermore, gas separation systems that are already required for hydrogen production, such as vacuum swing adsorption systems used to separate hydrogen from CO_2 and other non-condensable gases, are not Class 57 Property.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 5, please refer to Section 5.5. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	Hydrogen Compressor
E-101	Heat Exchanger	Waste Heat Boiler
E-102	Heat Exchanger	Natural Gas Inlet Heat Exchanger
E-103	Heat Exchanger	Cooling Water Heat Exchanger
E-104	SMR Heat Exchanger	SMR Natural Gas Inlet Heating
E-105	SMR Heat Exchanger	SMR Combustion Air Recuperator
F-101	Mesh Filter	Selective Catalytic Reformer
R-101	Reactor	Steam Methane Reformer
R-102	Reactor	Water Gas Shift Reactor
R-103	Reactor	Natural Gas Catalytic Pre-reformer
V-101	Gas-Liquid Separator	Hydrogen Water Knockout Drum
V-102	Packed Vessel	Pressure Swing Adsorption Package

Stream Number	Stream Type
1	Natural Gas Feed
2	H_2 - CO SMR Outlet
3	Combustion Air Inlet
4	H_2 - CO_2 Water Gas Shift Outlet
5	Reformed Natural Gas
6	SMR Process Inlet
7	Heated Combustion Air
8	Heat Recovery Water Feed
9	Steam Feed
10	Combustion Natural Gas
11	SMR Flue Gas
12	Water Condensate
13	Cooled H_2-CO_2
14	Dehydrated H_2-CO_2 Stream
15	Pure H_2 Return
16	Pressure Swing Vessel Tail Gas
17	VSA Pure H_2 Outlet
18	Compressed H_2 Outlet
19	Pretreated CO_2
20	Captured CO_2
21	Compressed and Purified CO_2
22	H_2-CO_2 Recycle Stream
23	Capture Steam Supply
24	Capture Condensate Return

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	Raw CO_2 Pre-Treatment	Section 2.1
REF-02	CO_2 Capture Process	Section 3
REF-03	Power and/or Heat and Water	Section 2.2
REF-04	CO_2 Compression and Purification	Section 2.3
REF-05	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

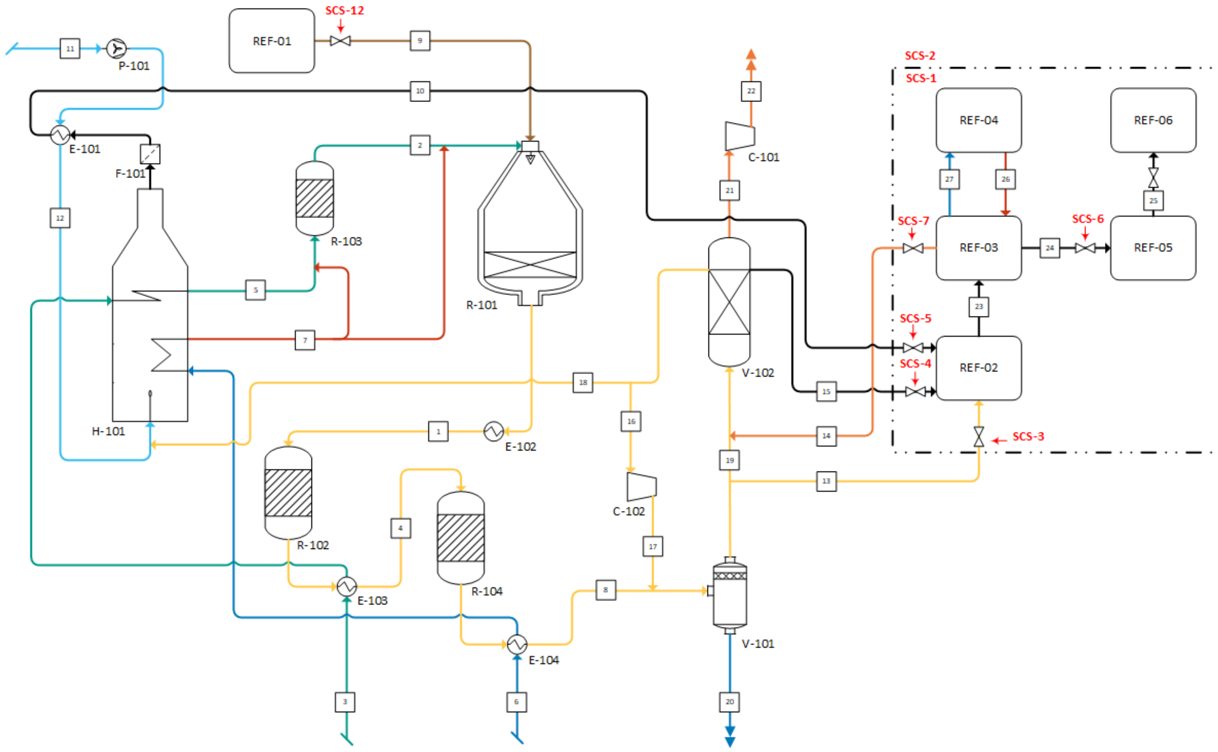
- CO_2
- Water
- H_2
- Steam
- Natural Gas
- O_2
- Syn Gas

Class 57 Property, Class 58 Property, or Dual-use Property

Figure 5.1-1: An example of carbon capture from SMR hydrogen production.

Figure Text Description: Diagram illustrating the boundaries from a SMR hydrogen production process. No aspects of this process are described in Class 57, Class 58, or the definition of dual-use equipment, including the steam methane reformer, water gas shift reactor, and heat exchanger. CCUS process boundaries start at SCS-3 where hydrogen enters a raw CO_2 pre-treatment process, SCS-7 where hydrogen exits a CO_2 capture process, and SCS-4 and SCS-5 where CO_2 enters a raw CO_2 pre-treatment process. For notes on process boundaries for this schematic and all other schematics in Section 5, please refer to Section 5.5, but not all notes apply to each schematic.

<u>NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 5, please refer to Section 5.5. Note that not all notes apply to each schematic.</u>



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	Hydrogen Compressor
C-102	Compressor	Recycle Compressor
E-101	Heat Exchanger	Oxygen Pre-Heater
E-102	Heat Exchanger	Syngas Cooler
E-103	Heat Exchanger	Natural Gas Reformer Pre-Heater
E-104	Heat Exchanger	Waste Heat Boiler
F-101	Mesh Filter	Selective Catalytic Reformer
H-101	Heater	Fired Heater
P-101	Blower	Air Blower
R-101	Reactor	Autothermal Reformer
R-102	Reactor	HT Water Gas Shift Reactor
R-103	Reactor	Natural Gas Catalytic Pre-reformer
R-104	Reactor	LT Water Gas Shift Reactor
V-101	Gas-Liquid Separator	Hydrogen Water Knockout Drum
V-102	Packed Vessel	Pressure Swing Adsorption Package

Stream Number	Stream Type
1	Water Gas Shift Reactor Feed
2	Reformed Natural Gas ATR Feed
3	Natural Gas Inlet
4	HT Water Gas Shift Reactor Outlet
5	ATR Natural Gas
6	Heat Recovery Water Feed
7	ATR Steam Feed
8	LT Water Gas Shift Reactor Outlet
9	Pure Oxygen
10	ATR Combustion Outlet Gas
11	Air
12	Pre-heated Air
13	Dehydrated H_2-CO_2 Stream
14	Pure H_2 Return
15	Pressure Swing Vessel Tail Gas
16	Syngas Recycle
17	Compressed Syngas Recycle
18	Syngas to Fired Heater
19	PSA Inlet
20	Water Condensate
21	PSA Pure H_2 Outlet
22	Product H_2
23	Pretreated CO_2
24	Captured CO_2
25	Compressed and Purified CO_2
26	Capture Steam Supply
27	Capture Condensate Return

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	Air Separation Unit	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Capture Process	Section 3
REF-04	Power and/or Heat and Water	Section 2.2
REF-05	CO_2 Compression and Purification	Section 2.3
REF-06	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

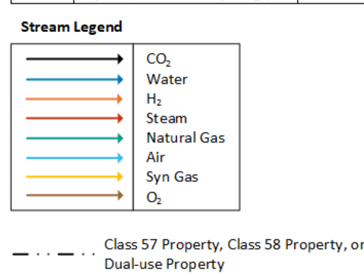


Figure 5.1-2: An example of carbon capture from ATR hydrogen production.

Figure Text Description: Diagram illustrating the boundaries from an ATR hydrogen production process. No aspects of this process are described in Class 57, Class 58, or the definition of dual-use equipment, including the autothermal reformer, water gas shift reactors, pre-reformers, and heat exchanger. Process boundaries begin at SCS-3 where hydrogen enters a raw CO_2 pre-treatment process, SCS-7 where hydrogen exits a CO_2 capture process, and SCS-4 and SCS-5 where CO_2 enters a raw CO_2 pre-treatment process. For notes on process boundaries for this schematic and all other schematics in Section 5, please refer to Section 5.5, but not all notes apply to each schematic.

5.2 Oxy-fuel Combustion

5.2.1 Carbon Capture from Oxy-fuel Combustion

Property that is not used solely for capturing carbon dioxide (described in Class 57 subparagraph (a)(i)), which may include property that is part of carbon capture from oxy-fuel combustion processes, is excluded from Class 57 equipment and is therefore not Class 57 Property.

In addition, property that is required for oxygen production (described in Class 57 subparagraph (a)(i)) is excluded from Class 57 equipment and is therefore not Class 57 Property.

However, property that separates CO_2 from specific process streams resulting from oxy-fuel combustion, which is a subset of technology within carbon capture processes (described in Class 57 clause (a)(i)(A)) may be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for capturing carbon dioxide that would otherwise be released into the atmosphere, is not oxygen production equipment, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
    - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

5.2.2 Pertinent Class 57 Property

Although property that is not used solely for capturing carbon dioxide is excluded from Class 57, property described in Class 57 subparagraph (a)(i) that is used solely for capturing carbon dioxide that results from oxy-fuel combustion may be eligible for the CCUS tax credit.

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process that captures carbon dioxide from oxy-fuel combustion will be based on the definitions set out in the Act and Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 5.2.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, property found in other sections of this Guide.

The purpose of this Section is to explicitly describe the process boundary between the Class 57 Property and ineligible property that is required for oxy-fuel combustion.

Note that certain property that is part of an oxy-fuel combustion process would be Class 57 Property if the process generates electrical energy, heat energy, or a combination of electrical or heat energy, that directly and solely supports a qualified CCUS project, unless the equipment uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project. Moreover, certain property would be Dual-use Property where more than 50% of either the electrical energy or heat energy that is expected to be produced over the total CCUS project review period, based on the most recent project plan, is expected to directly support a qualified CCUS project or a qualified clean hydrogen project, unless the equipment uses fossil fuels and emits carbon dioxide that is not subject to capture by a qualified CCUS project. See Section 2.2 and Section 1.6 for details on power and/or heat generation equipment that is Class 57 Property and Dual-use Property, respectively. All oxygen production equipment, regardless of its use within the CCUS project, is excluded from Class 57.

5.2.3 Typical Property Not Included in Class 57

Ineligible property within a process that captures carbon dioxide from oxy-fuel combustion includes, but is not limited to, the following:

- equipment used in an oxy-fuel combustion process that is also used in a non-CCUS process (e.g., hydrogen production process, industrial process) and is therefore not used solely for a CCUS process, such as:
  - power and/or heat generation equipment (e.g., boilers, steam turbines, gas turbines, heat recovery steam generators, burners, combustion chambers, air and fuel compressors, electrical power generators) used for produced power and/or heat;
  - pre-treatment cooling equipment (e.g., DCCs, condensing economizers, intercoolers, condensers, cooling water heat exchangers) used for cooling fluids;
  - purge gas treatment equipment (e.g., wash water absorption vessels, fluid circulation equipment, cooling equipment, pressure swing adsorption equipment, and ancillary equipment) that is required for treating purge gas;
- equipment used in an air separation unit (ASU) oxygen production process, such as:
  - air compression equipment (e.g., multistage centrifugal compressors, reciprocating compressors) to be used to compress atmospheric air to ASU operating conditions, including any mechanical fluid circulating equipment such as pumps, blowers, and fans;
  - air pre-treatment equipment (e.g., knockout drums, scrubbers, oil absorbers, filters, dryers), including separators for removing impurities such as moisture, dust, CO_2, and hydrocarbons;
  - heat exchange equipment (e.g., precoolers, intercoolers, condensers, heat exchangers, DCCs, turbo-expanders) to be used to cool the compressed air and resulting product streams and to transfer heat between warm and cold streams within the ASU system;
  - air separation systems (e.g., distillation columns, molecular sieves, semipermeable membranes, ion exchange resins, vortex tubes) to be used for separating oxygen from air;

    - oxygen liquefaction and storage equipment to be used for liquefying the oxygen for temporary storage and transportation in a liquid phase within the CCUS process, including cooling equipment, refrigeration cycle equipment, water and gas separation equipment, mechanical fluid circulation equipment, and storage equipment;

- equipment used in a water electrolysis process that produces oxygen; and
- handling, treatment, and storage equipment for nitrogen, argon, and other gaseous by-products (e.g., filters, fluid circulation equipment, cooling equipment, separation equipment, ancillary equipment).

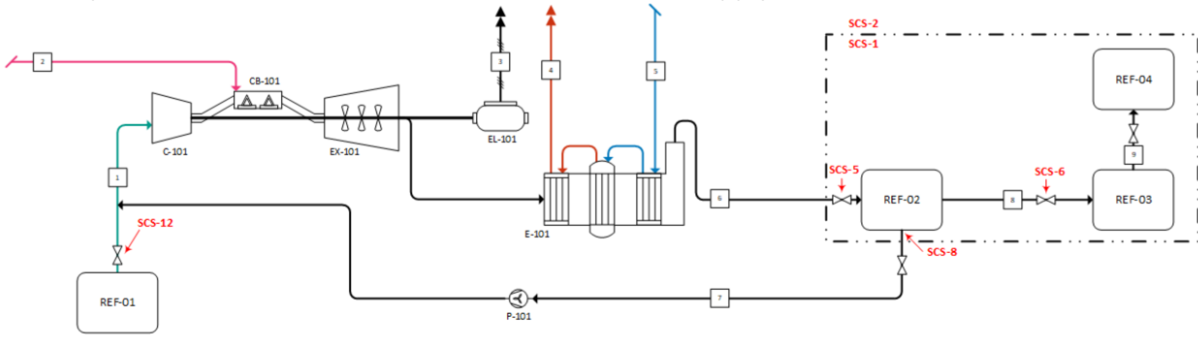
Please note that this list is not exhaustive and is meant to provide general guidance on property used commonly in oxyfuel combustion that is not Class 57 Property.

5.2.4 Schematic for Class 57 Property for Carbon Capture from Oxy-fuel Combustion

A schematic demarcating the process boundaries of a generic carbon capture process implemented on an oxy-fuel combustion process that uses a cryogenic ASU for producing oxygen and a gas turbine for power and/or heat production is shown as a representative example in Figure 5.2-1. The equipment and process boundaries of a typical cryogenic distillation ASU system applied on an oxy-fuel combustion process is shown as a representative example in Figure 5.2-2.

Note that equipment may differ between existing or proposed oxy-fuel combustion processes and the equipment depicted in this schematic, depending on the ASU technology used and the CO_2 source process to which it is applied. In the case of these processes, gas that exits the oxy-fuel combustion equipment is mostly CO_2, water vapour, non-condensable gases, unused oxygen, and traces of NO_x, and requires equipment for capturing carbon dioxide that may be Class 57 Property.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 5, please refer to Section 5.5. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	Combustion Air Compressor
CB-101	Combustion Chamber	Combustion Chamber
E-101	Heat Exchanger	Heat Recovery Steam Generator
EL-101	Electrical Infrastructure	Electrical Generator
EX-101	Turbine	Gas Turbine
P-101	Blower	Recycled Pretreated CO_2 Blower

Stream Number	Stream Type
1	Pure Oxygen Gas
2	Feed Fuel
3	Generated Electricity
4	Generated Steam
5	Boiler Feed Water
6	Raw CO_2
7	Recycled Pretreated CO_2
8	Pretreated CO_2
9	Compressed and Purified CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	Air Separation Unit	This Section
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Compression and Purification	Section 2.3
REF-04	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

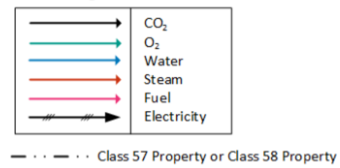
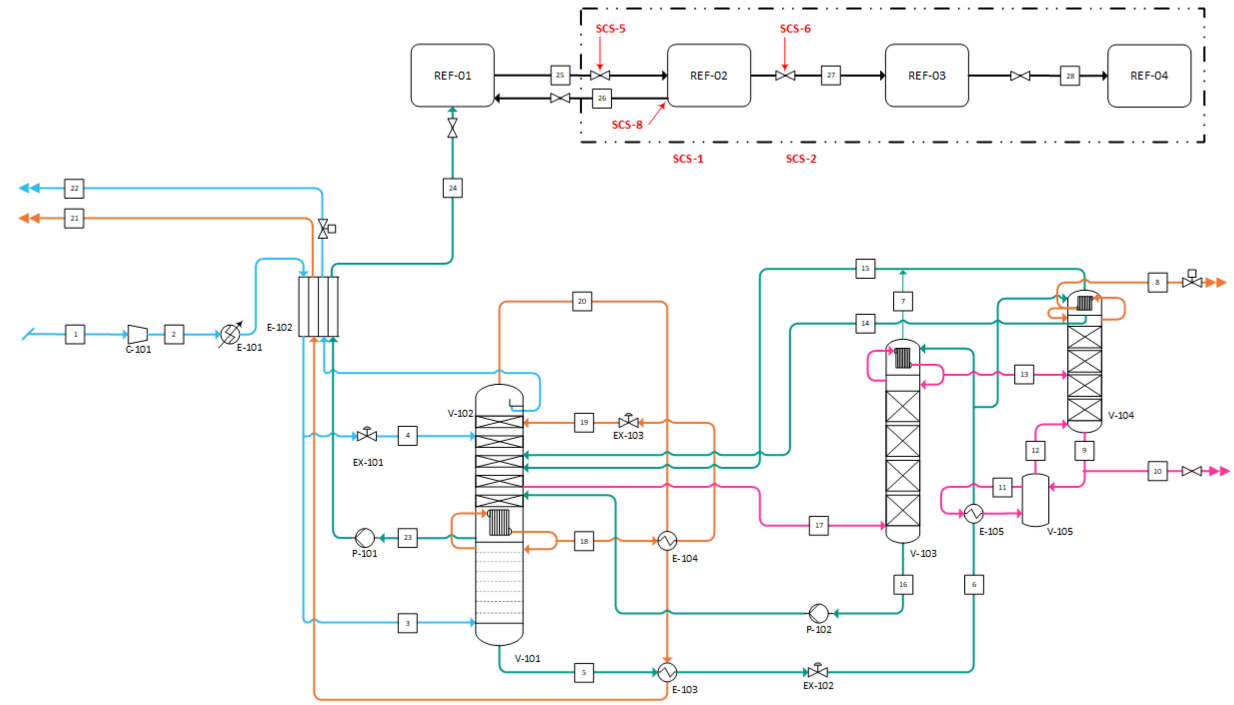


Figure 5.2-1: An example of carbon capture from an oxy-fuel combustion process using cryogenic air separation.

Figure Text Description: Diagram illustrating the boundaries from an oxy-fuel combustion process using cryogenic separation. No aspects of this process are described in Class 57, Class 58, or the definition of dual-use equipment, including the air separation unit, combustion chamber, heat exchanger, recycle blower and turbine. CCUS process boundaries begin at SCS-5 where CO_2 enters a raw CO_2 pre-treatment process and SCS-8 where CO_2 is recycled from a raw CO_2 pre-treatment process to a oxy-fuel combustion process. For notes on process boundaries for this schematic and all other schematics in Section 5, please refer to Section 5.5, but not all notes apply to each schematic.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 5, please refer to Section 5.5. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	Air Compressor
E-101	Heat Exchanger	Cooling Water HEX
E-102	Heat Exchanger	Main Air Separation Unit HEX
E-103	Heat Exchanger	Sub-Cooler HEX 1
E-104	Heat Exchanger	Sub-Cooler HEX 2
E-105	Heat Exchanger	Liquid Argon Evaporator
EX-101	Expander	Air Expansion Turbine
EX-102	Expander	Oxygen-Rich Liquid Expansion Valve
EX-103	Expander	Nitrogen Gas Expansion Valve
P-101	Pump	Cryogenic Oxygen Pump
P-102	Pump	Cryogenic Oxygen Pump
V-101	Distillation Column	High Pressure Cryogenic Distillation Column
V-102	Distillation Column	Low Pressure Cryogenic Distillation Column
V-103	Distillation Column	Crude Argon Cryogenic Distillation Column
V-104	Distillation Column	Pure Argon Distillation Column
V-105	Gas Liquid Separator	Reflux Drum

Stream Number	Stream Type
1	Air Inlet
2	Compressed Air
3	High Pressure Feed Air
4	Low Pressure Feed Air
5	High Pressure Oxygen-Rich Bottoms
6	Low Pressure Oxygen-Rich Liquid 1
7	Low Pressure Oxygen-Rich Liquid 2
8	Nitrogen Gas Impurity Outlet
9	Liquid Argon Bottoms
10	Liquid Argon Outlet
11	Reheated Argon
12	Reboiled Argon Gas
13	Liquid Argon Distillate
14	Low Pressure Feed Oxygen 1
15	Low Pressure Feed Oxygen 2
16	Argon Column Oxygen Bottoms
17	Liquid Crude Argon Return
18	High Pressure Nitrogen Gas Distillate
19	Low Pressure Feed Nitrogen
20	Low Pressure Nitrogen Gas Distillate
21	Nitrogen Gas Outlet
22	Nitrogen-Rich Air Outlet
23	Low Pressure Oxygen Bottoms
24	Pure Oxygen Gas
25	Raw CO_2
26	Recycled Pretreated CO_2
27	Pretreated CO_2
28	Compressed and Purified CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Compression and Purification	Section 2.3
REF-04	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

- CO_2
- Air
- N_2
- O_2
- Ar

Class 57 Property or Class 58 Property

Figure 5.2-2: An example of an ASU system with cryogenic distillation within a carbon capture from oxy-fuel combustion process.

Figure Text Description: Diagram illustrating the boundaries from an ASU system with cryogenic distillation. No aspect of the system is eligible, including the cryogenic distillation columns, heat exchangers, and pumps. Eligible boundaries begin at SCS-5 where CO_2 enters a raw CO_2 pre-treatment process and SCS-8 where recycled CO_2 exits a raw CO_2 pre-treatment process. For notes on process boundaries for this schematic and all other schematics in Section 5, please refer to Section 5.5, but not all notes apply to each schematic.

5.3 Natural Gas Processing

5.3.1 Carbon Capture from Natural Gas Processing

Property that is required for natural gas processing (described in Class 57 paragraph (a)) is excluded from Class 57 equipment and is therefore not Class 57 Property.

However, property that separates CO_2 from specific process streams resulting from natural gas processing, which is a subset of technology within carbon capture processes (described in Class 57 clause (a)(i)(A)) may be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for capturing carbon dioxide that would otherwise be released into the atmosphere, is not oxygen production equipment, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
    - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

5.3.2 Pertinent Class 57 Property

Although property that is expected to be used for natural gas processing is excluded from Class 57, property described in Class 57 subparagraph (a)(i) that is used solely for capturing carbon dioxide that results from natural gas processing may be eligible for the CCUS tax credit.

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process that captures carbon dioxide from natural gas processing will be based on the definitions set out in the Act and Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 5.3.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, property found in other sections of this Guide.

The purpose of this Section is to explicitly describe the process boundary between the Class 57 Property and ineligible property that is required for natural gas processing. Typically, this ineligible property serves the purpose of processing raw natural gas into "pipeline quality" dry natural gas. Property that serves both natural gas processing and capture of the resultant CO_2 stream does not meet the requirement of being used solely to capture CO_2 and is therefore not Class 57 Property.

5.3.3 Typical Property Not Included in Class 57

Ineligible property within a process that captures carbon dioxide from natural gas processing includes, but is not limited to, the following:

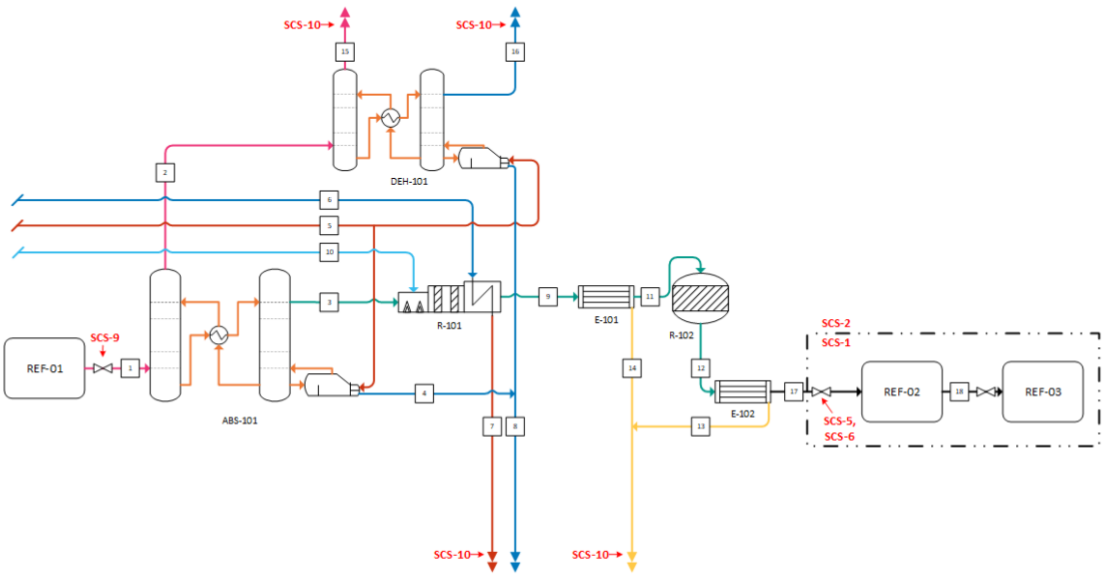
- equipment for oil and condensate removal (e.g., conventional separators, low temperature separators including heat exchangers, knockout vessels) that causes the oil and condensate associated with natural gas to condense out via gravity and pressure differentials;
- dehydrating equipment for removing water associated with natural gas using dehydrating agents either by the absorption or adsorption process (e.g., dehydrators, contactors, flash tank separator-condenser boilers, air- or water-cooled condensers, adsorption towers, desiccant materials, and control systems and instrumentation);
- equipment for separating natural gas liquids (NGLs) such as propane, butane, and pentanes using absorption and cryogenic processes (e.g., adsorption towers, pipes, expansion turbines) including natural gas liquid fractionation using fractionators;
- equipment meant for H_2S removal (e.g., sulfur recovery units, fixed bed reactors, heat exchangers, strippers, reflux drums, reboilers, pumps, fired heaters, gas separators, contactors, compressors, condensers) including equipment for converting the H_2S into sulfuric acid and subsequent injection;
- equipment used for heating natural gas to ensure that its temperature does not drop below the hydrate formation temperature (e.g., indirect fired heaters, hydrate inhibitors, dehydration units and low temperature units); and
- scrubbing equipment meant to remove sand and other large-particle impurities, (e.g., particle filters, coalescers, mesh pads, circulation pumps, spray towers, stirrers, compressors).

5.3.4 Schematic for Class 57 Property for Carbon Capture from Natural Gas Processing

A schematic demarcating the process boundaries of a generic carbon capture process implemented on a natural gas processing process that uses amine absorbent technology for acid gas separation is shown as a representative example in Figure 5.3-1.

Note that equipment may differ between existing or proposed natural gas processing processes and the equipment depicted in this schematic. In the case of these processes, gas that enters the carbon capture process is permitted to have some non-condensable gases and water content, but any property that is used for further processing of the natural gas stream additional to CO_2 separation is not Class 57 Property. Furthermore, gas separation systems that are required for natural gas processing – used to obtain dry quality natural gas from oil, condensate, water, and NGL – are not Class 57 Property.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 5, please refer to Section 5.5. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
ABS-101	Separation Package	Acid Gas Separation Process
DEH-101	Dehydration Package	Natural Gas Dehydration Process
E-101	Heat Exchanger	Sulfur Condenser 1
E-102	Heat Exchanger	Sulfur Condenser 2
R-101	Reactor	Sulfur Reactor, Steam Generator
R-102	Reactor	Sulfur Reactor

Stream Number	Stream Type
1	Unprocessed Natural Gas Inlet
2	Wet Natural Gas
3	Acid Gas to Claus Process
4	Steam Condensate
5	Steam Feed
6	Boiler Feed Water
7	Steam Outlet
8	Steam Condensate Outlet
9	Acid Gas
10	Combustion Air / Oxygen
11	Acid Gas
12	Reformed Acid Gas
13	Sulfur Condensate
14	Sulfur Condensate
15	Natural Gas to Liquids Separation
16	Waste Water
17	Pretreated and Captured CO_2
18	Compressed and Purified CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	Natural Gas Source Process	--
REF-02	CO_2 Compression and Purification	Section 2.3
REF-03	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

- CO_2
- Water
- Natural Gas
- Steam
- Acid Gases
- Sulfur
- Solvent/Absorbent
- Air/O_2

— · · — · · Class 57 Property or Class 58 Property

Figure 5.3-1: An example of carbon capture from natural gas processing.

Figure Text Description: Diagram illustrating the boundaries of a carbon capture process from natural gas processing. No aspects of this process are described in Class 57, Class 58, or the definition of dual-use equipment, including dehydration equipment, acid gas separation equipment, heat exchangers and reactor. CCUS process boundaries begin at SCS-5 and SCS-6 where CO_2 enters a raw CO_2 pre-treatment process. For notes on process boundaries for this schematic and all other schematics in Section 5, please refer to Section 5.5, but not all notes apply to each schematic.

5.4 Chemical Looping Carbon Capture

5.4.1 Chemical Looping Carbon Capture Processes

Property that is not used solely for capturing carbon dioxide (described in Class 57 subparagraph (a)(i)), which may include property that is part of carbon capture from chemical looping processes, is excluded from Class 57 equipment and is therefore not Class 57 Property.

However, property that separates CO_2 from specific process streams resulting from chemical looping, which is a subset of technology within carbon capture processes (described in Class 57 clause (a)(i)(A)) may be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for capturing carbon dioxide that would otherwise be released into the atmosphere, is not oxygen production equipment, and is not expected to be used for hydrogen production, natural gas processing, or acid gas injection; or
    - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

5.4.2 Pertinent Class 57 Property

Although property that is not used solely for capturing carbon dioxide is excluded from Class 57, property described in Class 57 subparagraph (a)(i) that is used solely for capturing carbon dioxide that results from chemical looping may be eligible for the CCUS tax credit.

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a process that captures carbon dioxide from chemical looping will be based on the definitions set out in the Act and Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 5.4.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, property found in other sections of this Guide.

The purpose of this Section is to explicitly describe the process boundary between the Class 57 Property and ineligible property that is required for chemical looping.

5.4.3 Typical Property Not Included in Class 57

Ineligible property within a process that captures carbon dioxide from chemical looping includes, but is not limited to, the following:

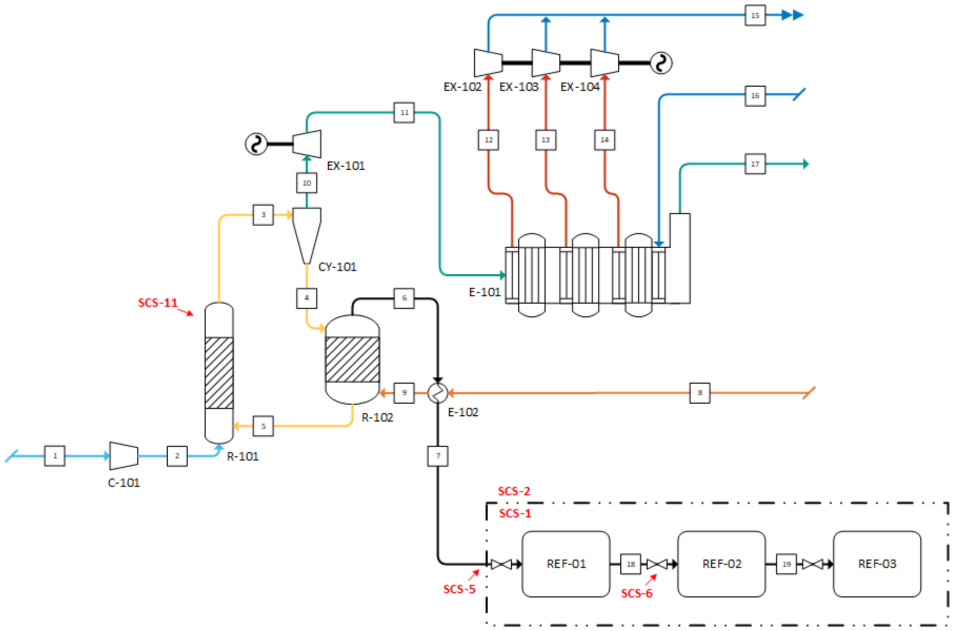
- fuel reactors (e.g., fluidized bed reactors) used for facilitating the reaction between gaseous, solid, or liquid hydrocarbon fuels and the solid oxygen carrier, including gasification reactors for converting solid fuels into combustible gases for use in fuel reactors;
- air reactors and regenerators (e.g., fluidized bed reactors, rotating kiln reactors) used for regenerating the oxygen carrier through an oxidation reaction, including burners and fuel supply equipment required to control the process heat, as well as equipment to control fluidization or rotary action;
- gas seals (e.g., loop seals, seal pots) used for controlling pressure and separation of gases and particulates between the two circulating reactors;
- solid handling equipment (e.g., rotary conveyors, hoppers, chutes, bins) used for moving the oxygen carrier or other materials not used solely in the CCUS process;
- solid separation equipment (e.g., cyclones, filters) that is to be used for separating fine particulates and spent oxygen carrier from the oxygen carrier circulation system;
- tanks, pressure vessels, and bins for holding the oxygen carrier or other materials not used solely in the CCUS process, as well as equipment that is used to maintain the materials at the necessary storage conditions, if necessary;
- equipment that produces hydrogen, including gasification or pyrolysis equipment that is used for processing solid or liquid fuels into hydrogen or synthesis gas, as well as chemical looping equipment integrated with autothermal reforming to produce hydrogen; and
- power generation equipment (e.g., steam turbine generators, expander generators) that is to be used solely to produce electrical power for a non-CCUS process, including any heat-producing equipment used for producing heat energy to drive the power generating equipment (e.g., steam boilers, duct burners, heat recovery steam generators).

5.4.4 Schematic for Class 57 Property for Carbon Capture from Chemical Looping

A schematic demarcating the process boundaries of a generic carbon capture process implemented on a chemical looping process that uses natural gas fuel is shown as a representative example in Figure 5.4-1.

Note that equipment may differ between existing or proposed chemical looping processes and the equipment depicted in this schematic, such as instances where fuels other than natural gas are used. In the case of these processes, gas that enters the carbon capture process is permitted to have some heat that is recovered as part of the raw CO_2 stream cooling process, but any property that is used for further processing of the raw CO_2 stream as part of a non-CCUS process is not Class 57 Property.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 5, please refer to Section 5.5. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	Inlet Air Compressor
CY-101	Cyclone	O_2 Carrier Cyclone
E-101	Heat Exchanger	Heat Recovery Steam Generator
E-102	Heat Exchanger	Fuel Preheat Exchanger
EX-101	Turbine	Gas Turbine
EX-102	Turbine	High Pressure Steam Turbine
EX-103	Turbine	Inter-Pressure Steam Turbine
EX-104	Turbine	Low Pressure Steam Turbine
R-101	Reactor	Air Reactor
R-102	Reactor	Fuel Combustion Reactor

Stream Number	Stream Type
1	Air Inlet
2	Compressed Air Feed
3	O_2 Rich Carrier + Hot Depleted Air
4	O_2 Rich Carrier
5	O_2 Lean Carrier
6	Hot Untreated CO_2
7	Raw CO_2
8	Natural Gas Inlet
9	Preheated Natural Gas
10	Hot Depleted Air
11	Hot Depleted Air
12	High Pressure Steam Turbine Steam Feed
13	Inter-Pressure Steam Turbine Steam Feed
14	Low Pressure Steam Turbine Steam Feed
15	Turbine Condensate Return
16	Boiler Feed Water
17	Exhaust Air
18	Pretreated CO_2
19	Compressed and Purified CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	Raw CO_2 Pre-Treatment	Section 2.1
REF-02	CO_2 Compression and Purification	Section 2.3
REF-03	CO_2 Transportation and CO_2 Storage/Use	Section 6 and Section 7-8

Stream Legend

- CO_2
- Water
- Natural Gas
- Steam
- O_2 Depleted Air
- Air
- O_2 Carrier

Class 57 Property or Class 58 Property

Figure 5.4-1: An example of carbon capture from a chemical looping process.

Figure Text Description: Diagram illustrating the boundaries of a carbon capture process from a chemical looping process. No aspects of this process are described in Class 57, Class 58, or the definition of dual-use equipment, including turbines, air reactor, fuel reactor, cyclones, and heat exchangers. CCUS process boundaries begin at SCS-5 where CO_2 enters a raw CO_2 pre-treatment process. For notes on process boundaries for this schematic and all other schematics in Section 5, please refer to Section 5.5, but not all notes apply to each schematic.

5.5 Process Boundary Notes on Schematics of Carbon Capture Processes with Ineligible Property

A key to the process boundary notes on the schematics is provided here and includes the definition of process boundaries for carbon capture processes with ineligible property.

SCS-1	For descriptions of the Class 57 Property included within this process boundary, see Section 5.1.2, 5.2.2, 5.3.2, and 5.4.2 of this Guide.
SCS-2	For descriptions of ineligible property that may be contained within this process boundary, see Section 5.1.3, 5.2.3, 5.3.3, and 5.4.3 of this Guide.
SCS-3	The raw CO_2-H_2 process gas supply piping from the hydrogen production process that is used by a carbon capture process is described in Class 57 clause (a)(i)(A) and begins at, and includes, the first control valve that is used solely by property described in Class 57 clause (a)(i)(A). Where there is no control valve as described above, the process boundary for the carbon capture process is the point where the piping for the raw CO_2-H_2 process gas supply system physically connects to the property described in Class 57 clause (a)(i)(A).
SCS-4	The CO_2 supply piping from the H_2-CO_2 hydrogen production-dedicated separation unit that is used by a carbon capture process is described in Class 57 clause (a)(i)(A) and begins at, and includes, the first control valve that is used solely by property described in Class 57 clause (a)(i)(A). Where there is no control valve as described above, the process boundary for the carbon capture process is the point where the piping for the CO_2 supply system physically connects to the property described in Class 57 clause (a)(i)(A).
SCS-5	The CO_2 supply piping that is used by a carbon capture process is described in Class 57 clause (a)(i)(A) and begins at, and includes, the first control valve that is used solely by property described in Class 57 clause (a)(i)(A). Where there is no control valve as described above, the process boundary for the carbon capture process is the point where the piping for the CO_2 supply system physically connects to the property described in Class 57 clause (a)(i)(A).
SCS-6	The process boundary of the CO_2 piping system that is used by a carbon capture process begins at the points indicated in SCS-3, SCS-4, or SCS-5 and ends at the first control valve along the piping after property described in Class 57 subparagraph (a)(i), excluding the control valve itself.
SCS-7	Components of the hydrogen return line to the hydrogen production system, including any mechanical circulation or filter equipment, are outside the process boundary. The process boundary for a carbon capture process is the point where the piping for the hydrogen return stream physically connects to the property described in Class 57 clause (a)(i)(A) and does not contain the piping itself.

SCS-8 Components of the CO_2 recycle line to a non-CCUS process, including any mechanical circulation or filter equipment, are outside the process boundary. The process boundary for a carbon capture process is the point where the piping for the CO_2 recycle line physically connects to the property described in Class 57 clause (a)(i)(A) and does not contain the piping itself.

SCS-9 Components of the upstream natural gas supply infrastructure, including wells, satellite facilities, battery facilities, and piping, are outside the carbon capture process boundary and are not included in Class 57.

SCS-10 Equipment used for process streams generated during natural gas processing, other than the raw CO_2 emissions stream are outside the carbon capture process boundary and are not included in Class 57. This includes subsequent natural gas processing steps, such as natural gas liquid separation and fractionation.

SCS-11 Components of the chemical looping reactors are used in a non-CCUS process and are outside the carbon capture process boundary and are not included in Class 57. This includes oxygen carrier circulation equipment, gasification equipment, disposal systems, as well as the fuel, air, and steam supply systems. The process boundary for the carbon capture process is described in SCS-6 and will often begin after a fuel reactor or fuel reactor pre-heater.

SCS-12 The entirety of an air separation unit used to supply oxygen to a hydrogen production process or oxy-fuel combustion process is outside the carbon capture process boundary and is excluded from Class 57.

6 Transportation Processes

6.1 Carbon Transportation

6.1.1 Carbon Transportation Processes

Carbon transportation processes use pipeline or non-pipeline equipment and vessels to transport captured carbon for the purpose of delivery from a carbon capture process or CO_2 purification and compression process to a carbon storage or carbon use process.

Property that is part of a carbon transportation process (described in Class 57 paragraph (b)), could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for transportation of captured carbon, including equipment used for the transportation system safety and integrity; or
    - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

6.1.2 Pertinent Class 57 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a carbon transportation process will be based on the definitions set out in the Act and the Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 6.1.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, the following:

- temporary CO_2 storage equipment (e.g., tanks, recirculation pumps, return lines for boil-off gas) that is to be used for holding captured CO_2, including liquefaction equipment (e.g., compressors, condensers, flash drums, valves, separation vessels) to liquefy CO_2 and condition it to temporary storage conditions;
- equipment for pipeline transportation that is to be used for transporting CO_2 and conditioning or re-conditioning CO_2 to transport conditions:
    - pipelines that are to be used for transporting the CO_2 towards its storage or use site, including specialized coatings and materials to mitigate risks associated with corrosion, leaks, rupture, and other safety or performance risks, as well as equipment for cathodic protection systems;

- crack arrestors that are to be used for stopping the propagation of a pipeline crack in the case of a leak;
- pigging equipment (e.g., pigs, scrapers, pig launchers, pig receivers) that is to be used for cleaning the interior of a CO_2 pipeline, supporting start-up and depressurization, and testing the integrity of the pipeline;
- booster pump station or compression equipment that is located along the pipeline (e.g., pumps, compressors, heat exchangers, filters, scrubbers, control equipment) that is to be used for re-conditioning CO_2 to the requisite transportation conditions;
- valve station equipment (e.g., block valves, valve seals, check valves, control valves) that is to be used for sectioning the pipeline in the event of leaks, ruptures, maintenance, and similar events; and
- blowdown station equipment (e.g., blowdown units, vents, block valves) that is to be used for isolating a section of the pipeline in the event of rupture;

- equipment for non-pipeline transportation such as ship, barge, truck, or rail transportation that is to be used solely for loading, transporting, and unloading CO_2:
  - CO_2 transportation vessels (e.g., ships, barges, trucks, railcars) that are to be used solely for transporting CO_2 from the loading to the unloading facility and supporting the function of the transportation vessel, including liquefaction or reliquefaction equipment (e.g., compressors, condensers, evaporators, heat exchangers, expanders, flash drums, valves, pumps, separation vessels) that is to be used to liquefy CO_2 or re-condition it to temporary storage or transportation conditions;
  - Loading and unloading equipment (e.g., articulated or other loading arms, cryogenic hoses, cryogenic pumps, insulated pipelines for transfer from storage to loading arms, return lines for boil-off gas, valves, joints, fittings) that is to be used for transferring the CO_2 onto and off the CO_2 transportation vessel; and
  - Regasification equipment (e.g., pumps, heat exchangers, vaporizers, compressors, condensers) that is to be used for bringing liquefied CO_2 to the required conditions for further transportation or for storage or use;
- mechanical fluid circulation equipment (e.g., pumps, compressors, and expanders) that is to be used for moving CO_2 and fluids during carbon transportation;
- CO_2 loading and unloading equipment (e.g., top and bottom loading arms and loaders, chemical hoses, pumps, vapour recovery lines, valves, joints, fittings), including mechanical circulation equipment, that is to be used solely for transferring chemicals and fluids between tanks and transportation vessels that are used within or removed from the CCUS process; and
- any other property that is described in Class 57 in relation to a carbon transportation process, including, but not limited to, ancillary equipment, monitoring and control equipment, and buildings or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

Certain property that supports a carbon transportation process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, may also be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates electrical energy in support of a qualified CCUS project;
- distribution equipment that distributes electrical energy in support of a qualified CCUS project; and
- transmission equipment that transmits electrical energy in support of a qualified CCUS project.

6.1.3 Typical Property Not Included in Class 57

Property used in the carbon transportation process that is not Class 57 Property is ineligible for the CCUS tax credit. Examples of typical property not included in Class 57 include the following:

- equipment that is used in a carbon transportation process that is also used in a non-CCUS process (e.g., natural gas transportation, hydrogen transportation) and is therefore not used solely for a CCUS process, such as:
    - loading and unloading equipment, as well as transportation vessels that are used, for example, to transport other fluids such as liquefied natural gas or liquefied petroleum gas in addition to transportation of CO_2. This includes tankers, barges, trucks, or railcars that carry CO_2 in one direction and another fluid in the opposite direction;
- infrastructure required as part of the transportation route including roads, highways, railroad tracks, locks, and similar infrastructure; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note, this list is not exhaustive and is meant to provide general guidance on typical property used in a carbon transportation process that is not Class 57 Property.

6.1.4 Typical Capital Costs Included in Class 57

Typical capital costs when constructing a carbon transportation process that is part of a CCUS project would include the costs provided in Table 6.1-1:

Table 6.1-1 Project cost table for carbon transportation processes

Capital cost of Class 57 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. These costs may be attributed to the following technical applications as part of carbon transportation process, provided the property is Class 57 Property such as, but not limited to, the Class 57 Property described in Section 6.1.2 or Section 1.5.1:	
1	CO_2 transportation pipelines, including pigging, pressure boosting, blowdown, and cathodic protection system equipment, as well as trenching and backfilling
2	CO_2 transportation vessels, including on-board boil-off CO_2 return and reliquefaction equipment
3	CO_2 liquefaction and regasification equipment
4	Temporary CO_2 storage tanks

5	CO_2 loading and unloading equipment
6	Mechanical fluid circulation equipment
7	Electricity generation equipment – see Section 2.2 for details
8	Electricity distribution equipment – see Section 2.2 for details
9	Electricity transmission equipment – see Section 2.2 for details
10	Electrical system equipment
11	Liquid delivery and distribution equipment
12	Utility cooling system equipment
13	Material handling and storage and distribution system equipment, including holding tanks, conditioning equipment, and fluid transfer equipment
14	Venting system equipment
15	Process waste management system equipment
16	Compressed utility air or nitrogen system equipment
17	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
18	System integrity equipment, including pigging equipment
19	Process safety equipment
20	Flow control and containment equipment
21	Buildings or other structures
22	Equipment for conversion of existing property into Class 57 Property
23	Equipment for refurbishment of existing Class 57 Property

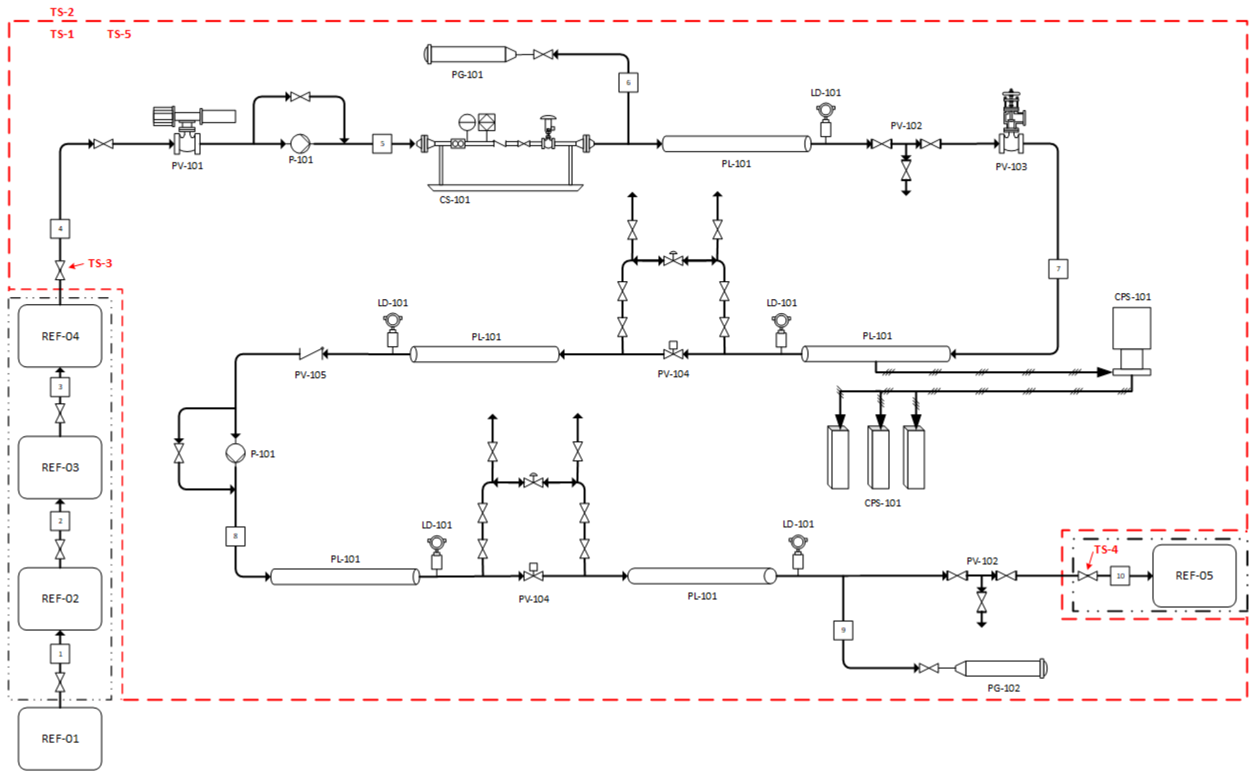
6.1.5 Schematics for Class 57 Property in Carbon Transportation Processes

Some typical elements of a CCUS process that can transport captured carbon are shown in Figure 6.1-1 and Figure 6.1-2. Process boundaries defined here are for typical carbon transportation processes, using schematics of a pipeline system and of a vehicle, ship, or barge transportation system as representative examples.

However, note that the specific property that is used in a carbon transportation process may depend on the specific application used in the CCUS process. Ultimately, whether particular property is Class 57 Property will depend on its function within the CCUS process.

In some cases, CO_2 purification and compression equipment may be installed along the carbon transportation process but would not be considered carbon transportation property (as described in Class 57 paragraph (b)). For more details on CO_2 purification and compression technology, please refer to Section 2.3.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 6, please refer to Section 6.2. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
CPS-101	Cathodic Protection	Cathodic Protection System
CS-101	Control Skid	CO_2 Injection Control Skid
LD-101	Detector	Leak Detection Device
P-101	Pump	Booster Pump
PG-101	Pigging Equipment	Pig Launcher
PG-102	Pigging Equipment	Pig Receiver
PL-101	Pipeline	CO_2 Pipeline
PV-101	Valve	Emergency Shutdown Valve
PV-102	Valve	Block Valve
PV-103	Valve	Blowdown Valve
PV-104	Valve	Line Break Valve
PV-105	Valve	Check Valve

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Captured CO_2
4	Compressed and Purified CO_2
5	Boosted Pipeline CO_2
6	CO_2 Pig Launcher Vent
7	Pipeline CO_2
8	Boosted Pipeline CO_2
9	CO_2 Pig Receiver Vent
10	Storage Feed CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Capture	Section 3
REF-04	CO_2 Compression and Purification	Section 2.3
REF-05	CO_2 Storage/CO_2 Use	Section 7-8

Stream Legend

⟶	CO_2

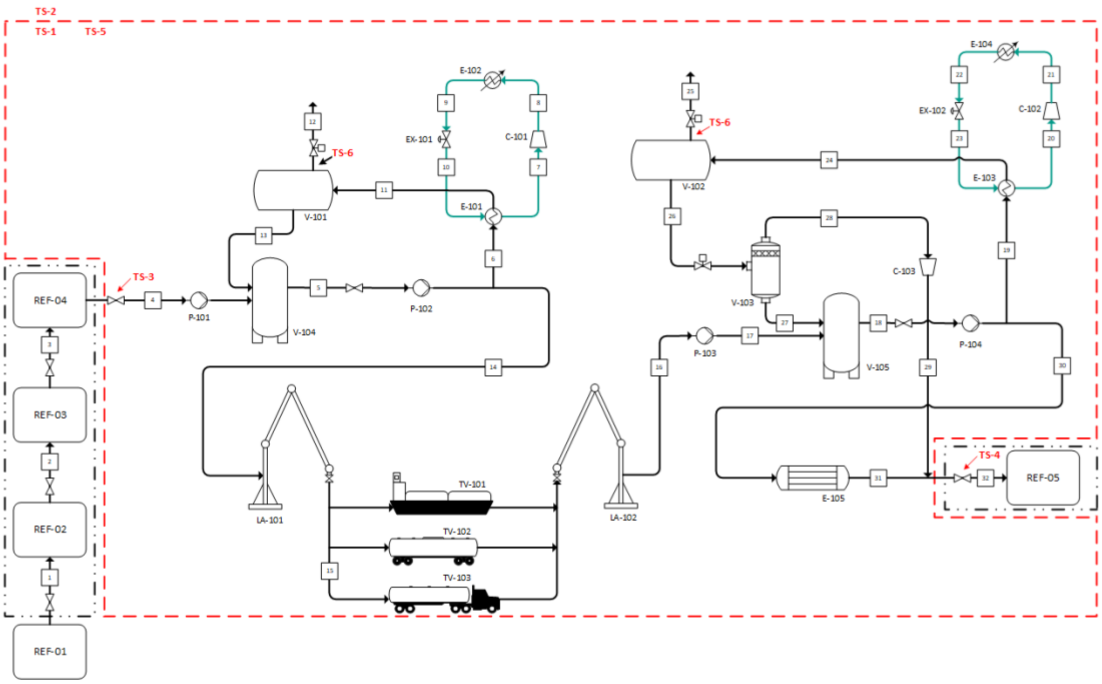
Class 57 Property for a Pipeline Carbon Transportation Process

Other Class 57 Property or Class 58 Property

Figure 6.1-1: An example of a carbon transportation process using a pipeline.

Figure Text Description: Diagram illustrating the boundaries of a carbon transportation process using a pipeline. The boundary begins at TS-3 where CO_2 exits a CO_2 purification and compression process, and includes equipment such as pipelines, pumps, pigging equipment, cathodic protection systems, and leak detection. The boundary ends at TS-4 where the CO_2 is passed to a CO_2 storage/CO_2 use process. For notes on process boundaries for this schematic and all other schematics in Section 6, please refer to Section 6.2, but not all notes apply to each schematic.

NOTE: For keys to the process boundary notes on this schematic, as well as the other schematics in Section 6, please refer to Section 6.2. Note that not all notes apply to each schematic.



Equipment Identifier	Equipment Type	Equipment Description
C-101	Compressor	Refrigerant Compressor
C-102	Compressor	Refrigerant Compressor
C-103	Compressor	Boil-Off CO_2 Compressor
E-101	Heat Exchanger	CO_2-Refrigerant Reliquefaction HEX
E-102	Heat Exchanger	Refrigerant Condenser
E-103	Heat Exchanger	CO_2-Refrigerant Reliquefaction HEX
E-104	Heat Exchanger	Refrigerant Condenser
E-105	Heat Exchanger	CO_2 Vaporizer
EX-101	Expander	Refrigerant Expansion Valve
EX-102	Expander	Refrigerant Expansion Valve
LA-101	Loading Arm	CO_2 Loading Arm
LA-102	Loading Arm	CO_2 Unloading Arm
P-101	Pump	Liquefaction Storage Pump
P-102	Pump	Liquefaction Transport Pump
P-103	Pump	Regasification Storage Pump
P-104	Pump	Regasification Transport Pump
TV-101	Transport Vehicle	CO_2 Transport Ship
TV-102	Transport Vehicle	CO_2 Transport Railcar
TV-103	Transport Vehicle	CO_2 Transport Truck
V-101	Gas-Liquid Separator	Liquid CO_2 Separator
V-102	Gas-Liquid Separator	Liquid CO_2 Separator
V-103	Gas-Liquid Separator	Liquid CO_2 Flash Drum
V-104	Pressure Vessel	Liquefaction Storage Vessel
V-105	Pressure Vessel	Regasification Storage Vessel

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Captured CO_2
4	Compressed and Purified CO_2
5	CO_2 from Liquefaction Storage
6	Reliquefaction CO_2
7	Warm Refrigerant
8	Compressed Refrigerant
9	Condensed Refrigerant
10	Cooled Refrigerant
11	Reliquefied CO_2 1
12	Purge Gas
13	Reliquefied CO_2 2
14	CO_2 for Transport
15	CO_2 in Transport
16	CO_2 from Transport
17	CO_2 to Regasification Storage
18	CO_2 from Regasification Storage
19	Reliquefaction CO_2
20	Warm Refrigerant
21	Compressed Refrigerant
22	Condensed Refrigerant
23	Cooled Refrigerant
24	Reliquefied CO_2 1
25	Purge Gas
26	Reliquefied CO_2 2
27	Purified Reliquefied CO_2
28	Boil-Off CO_2
29	Compressed Boil-Off CO_2
30	Liquid Regasification CO_2
31	Regasified CO_2
32	Storage Feed CO_2

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Capture Process	Section 3
REF-04	CO_2 Compression and Purification	Section 2.3
REF-05	CO_2 Storage/CO_2 Use	Section 7-8

Stream Legend

CO_2
Refrigerant

Class 57 Property for a Non-Pipeline Carbon Transportation Process

Other Class 57 Property or Class 58 Property

Figure 6.1-2: An example of a carbon transportation process using a transportation vehicle.

Figure Text Description: Diagram illustrating the boundaries of a carbon transportation process using a transport vehicle. The boundary begins at TS-3 where CO_2 exits a CO_2 purification and compression process, and includes equipment such as compressors, heat exchangers, loading arms, pumps, and transport vehicles. The boundary ends at TS-4 where the CO_2 is passed to a CO_2 storage/CO_2 use process. For notes on process boundaries for this schematic and all other schematics in Section 6, please refer to Section 6.2, but not all notes apply to each schematic.

6.2 Process Boundary Notes on Schematics of Carbon Transportation Processes

A key to the process boundary notes on the schematics is provided here and includes the definition of process boundaries for typical carbon transportation processes.

TS-1 For descriptions of the Class 57 Property included within this process boundary, see Section 6.1.2 of this Guide

TS-2 For descriptions of ineligible property that may be contained within this process boundary, see Section 6.1.3 of this Guide.

TS-3 The CO_2 supply piping that is used by a carbon transportation process is described in Class 57 paragraph (b) and the process boundary begins at, and includes, the first control valve that is used solely by property described in Class 57 paragraph (b), after an immediately upstream CO_2 purification and compression, carbon capture, or direct air capture process and begins at the point indicated by the terminal boundary for a CO_2 purification and compression process described in CSS-5, CS-4, or DACS-5, respectively. Where there is no control valve as described above, the process boundary for the carbon transportation process is the point where the piping for the CO_2 supply system physically connects to the property described in Class 57 paragraph (b).

TS-4 The process boundary of the CO_2 piping system that is used by a carbon transportation process begins at the point indicated by TS-3 and ends at the first control valve along the piping after property described in Class 57 paragraph (b), excluding the control valve itself. Often, this will be near the point where the piping enters a carbon storage site.

TS-5 The schematic provides a general layout of typical valves and other equipment found along a CO_2 pipeline system. However, the type and frequency of equipment will vary depending on each individual CO_2 pipeline system. In general, the quantity of valves and stations will increase with the length of the CO_2 pipeline system.

TS-6 The process venting system used solely by a carbon transportation process is described in Class 57 paragraph (d) and includes piping and components that are used solely to release gases from Class 57 Property. The carbon transportation process boundary related to the process venting system begins at the point where the piping for the process venting system physically connects to the property described in Class paragraph (b) and includes all piping and venting equipment.

6.2.1 Class 57 Property Not Shown in the Schematics of Carbon Transportation Processes

There are other property and systems ancillary to carbon transportation process that are not explicitly shown in the schematics but are still part of the CCUS process*.*

- The cooling system used by a carbon transportation process is described in Class 57 paragraph (d) and includes piping and components that are used solely to deliver cooling fluid (e.g., cooling water, air, glycol) to and from the Class 57 Property. The carbon transportation process boundary related to the cooling system begins at, and includes, the first control valve along the piping or ducting system that is used solely by the Class 57 Property and includes all piping or ducting downstream, up to and including the last control valve along the piping or ducting system that is used solely by the Class 57 Property. These points are located before and after the property described in Class 57 paragraph (b). If the whole cooling system is used solely by Class 57 Property, all piping and components are within the process boundaries of these processes. Otherwise, the carbon transportation process boundary related to the cooling systems is the point where the piping for the cooling system physically connects to the property described Class 57 paragraph (b).
- The utility air or nitrogen distribution system used by a carbon transportation process is described in Class 57 paragraph (d) and includes piping and components that are used solely to supply utility air or nitrogen for the operation of equipment (e.g., pneumatic) and control systems (e.g., actuators) that is Class 57 Property. The carbon transportation process boundary related to the utility air or nitrogen distribution system begins at, and includes, the first control valve along the piping system that is used solely by the Class 57 Property and includes all piping downstream, up to the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 57 paragraph (b). Otherwise, the carbon transportation process boundary related to the utility air or nitrogen distribution system is the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 57 paragraph (b).
- The electrical system used by a carbon transportation process is described in Class 57 paragraph (d) and includes wiring and components that are used solely to supply electrical energy for the operation of equipment that is Class 57 Property. The carbon transportation process boundary related to the electrical system begins at, and includes, the first isolation switch along the wiring system that is used solely by the Class 57 Property and includes all wiring downstream, up to the point where the wiring for the electrical system physically connects to the property described in Class 57 paragraph (b). Otherwise, the carbon transportation process boundary related to the electrical system is the point where the wiring for the electrical system physically connects to the property described in Class 57 paragraph (b).
- The power distribution system that supports a carbon transportation process is described in Class 57 subparagraph (a)(iii) or subparagraph (a)(iv) in the definition of dual-use equipment and is not within the carbon transportation process boundary. The carbon transportation process boundary related to the power distribution system begins at the point where the power lines for

the power distribution system physically connect to the property described in Class 57 paragraph (b).

- The fuel supply system used by a carbon transportation process is described in Class 57 paragraph (d) and includes piping and components used solely to deliver fuel to Class 57 Property. The carbon transportation process boundary related to the fuel supply system begins at, and includes, the first control valve along the piping that is used solely by Class 57 Property and includes all piping up to the point where the piping physically connects to the property described in Class 57 paragraph (b).

7 Storage Processes

7.1 Carbon Storage

7.1.1 Carbon Storage Processes

Carbon storage processes use injection or other storage equipment to inject captured carbon into geological formations for the purpose of permanent storage.

Property that is part of a carbon storage process (described in Class 57 paragraph (c)), could be Class 57 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
  - the property is to be used solely for storage of captured carbon in a geological formation, including equipment used for the storage system safety and integrity, but not including equipment used for enhanced oil recovery; or
  - the property is described in Class 57 paragraphs (d)-(g) in relation to the equipment described above.

The capital cost of Class 57 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

7.1.2 Pertinent Class 57 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 57 Property within a carbon storage process will be based on the definitions set out in the Act and the Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 7.1.1 to be Class 57 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 57 Property could include, but are not limited to, the following:

- injection pumps skids that are to be used for pressurizing, injecting and re-injecting CO_2 into geological formations, including triplex plunger pumps and booster pumps;
- line heaters or similar heating equipment that are to be used for heating the captured carbon to the required temperature for injection into a geological formation, including temperature and pressure gauges;
- surface equipment that is to be used for injecting captured carbon into geological formations for permanent storage including wellhead and control equipment;
- CO_2 injection well tubing, casing, cement, and downhole equipment such as packers and seals for the injection of CO_2 into geological formations for permanent storage;

- CO_2 monitoring well tubing, casing, cement, and downhole equipment such as packers and seals for monitoring the sub-surface and ensuring storage conformance of CO_2;
- permanently installed leak detection equipment that tracks CO_2 through the carbon storage process and well-based monitoring for the purpose of ensuring storage conformance (e.g., monitoring induced seismicity, monitoring potential CO_2 leakage), including pressure and temperature gauges, fluid-sampling ports and lines, geophones, fibre cables, and acoustic and temperature sensing;
- equipment upstream of the wellhead used to contain and control the flow of fluids (e.g., piping, tubing, ducting, valves, controllers, flow meters, and similar ancillary equipment), including full-flow pressure relief valves for protection against over-pressurization near the wellhead; and
- any other property that is described in Class 57 in relation to a carbon storage process, including, but not limited to, ancillary equipment, monitoring and control equipment, and buildings or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

Certain property that supports a carbon storage process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, may also be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates electrical energy in support of a qualified CCUS project;
- distribution equipment that distributes electrical energy in support of a qualified CCUS project; and
- transmission equipment that transmits electrical energy in support of a qualified CCUS project.

7.1.3 Typical Property Not Included in Class 57

Property used in the carbon storage process that is not Class 57 Property is ineligible for the CCUS tax credit. Examples of typical property not included in Class 57 include the following:

- equipment that is used in a carbon storage process that is also used in a non-CCUS process (e.g., wastewater injection, sub-terranean hydrogen storage) and is therefore not used solely for a CCUS process;
- equipment used for enhanced oil recovery; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note, this list is not exhaustive and is meant to provide general guidance on common property that is not Class 57 Property.

Property that is part of a CCUS project of a taxpayer and that is equipment that is to be used solely for using carbon dioxide for enhanced oil recovery is not included in Class 57 but is described in Class 58 paragraph (a). This equipment may be Class 58 Property but would not be eligible for the CCUS tax credit.

Intangible property associated with exploration for storage, drilling, completing, and converting wells for permanent storage of captured carbon is not included in Class 57 but is described in Classes 59 and 60. This property is not Class 57 Property or Class 58 Property.

7.1.4 Typical Capital Costs Included in Class 57

Typical capital costs when constructing a carbon storage process that is part of a CCUS process would include the costs provided in Table 7.1-1:

Table 7.1-1 Project cost table for carbon storage processes in geological formation

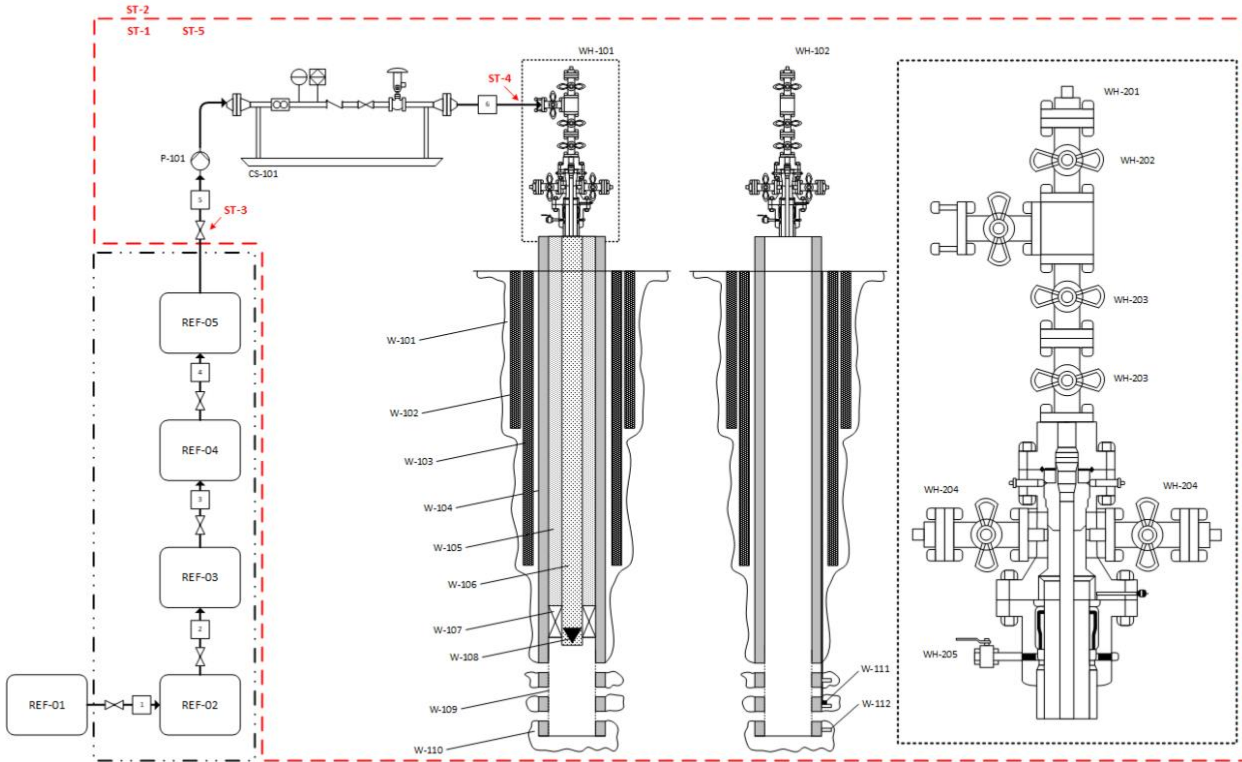
Capital cost of Class 57 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. **These costs may be attributed to the following technical applications as part of carbon storage process, provided the property is Class 57 Property such as, but not limited to, the Class 57 Property described in Section 7.1.2 or Section 1.5.1:**	
1	CO_2 injection equipment, including pump skids and pressure release equipment
2	CO_2 liquefaction and gasification equipment
3	CO_2 unloading equipment
4	Well-based monitoring and leak detection equipment
5	Electricity generation equipment – see Section 2.2 for details
6	Electricity distribution equipment – see Section 2.2 for details
7	Electricity transmission equipment – see Section 2.2 for details
8	Electrical system equipment
9	Utility cooling system equipment
10	Material handling and storage and distribution system equipment, including temporary CO_2 storage tanks , CO_2 return lines, and vapour and liquid pressure equalization lines
11	Venting system equipment
12	Compressed utility air or nitrogen system equipment
13	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
14	System integrity equipment
15	Process safety equipment
16	Flow control and containment equipment
17	On-site piping from a main carbon transportation system or temporary CO_2 storage to the injection well
18	Buildings or other structures
19	Equipment for conversion of existing property into Class 57 Property
20	Equipment for refurbishment of existing Class 57 Property

7.1.5 Schematic for Class 57 Property in Carbon Storage Processes

Some typical elements of a CCUS process that can be used to store captured CO_2 in a geological formation (other than for enhanced oil recovery) are shown in Figure 7.1-1. Process boundaries defined here are for a typical carbon storage process, using a schematic of an injection system as a representative example.

However, note that the specific property that is used in a carbon storage process may depend on the specific application used in the CCUS process. Ultimately, whether particular property is Class 57 Property will depend on its function within the CCUS process.

NOTE: For keys to the process boundary notes on this schematic, please refer to Section 7.2.



Equipment Identifier	Equipment Type	Equipment Description
CS-101	Control Skid	CO_2 Injection Control Skid
P-101	Pump	Injection Pump
W-101	Injection Well	Cement
W-102	Injection Well	Surface Casing
W-103	Injection Well	Intermediate Casing
W-104	Injection Well	Long String Casing
W-105	Injection Well	Casing Annulus
W-106	Injection Well	Injection Tubing
W-107	Injection Well	Packer
W-108	Injection Well	Backflow Preventor
W-109	Injection Well	Perforation
W-110	Injection Well	Acid Resistant Cement
W-111	Monitoring Well	Fluid Recovery System
W-112	Monitoring Well	Downhole Pressure Gauges
WH-101	Wellhead	Injection Wellhead
WH-102	Wellhead	Monitoring Wellhead
WH-201	Wellhead	Tree Cap
WH-202	Wellhead	Swab Valve
WH-203	Wellhead	Master Valve
WH-204	Wellhead	Casing Annulus Valve
WH-205	Wellhead	Bradenhead Valve

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Captured CO_2
4	Compressed and Purified CO_2
5	Storage Feed CO_2
6	CO_2 to Wellhead

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Capture	Section 3
REF-04	CO_2 Compression and Purification	Section 2.3
REF-05	CO_2 Transportation	Section 6

Stream Legend

→	CO_2

— — Class 57 Property for a Geological Carbon Storage Process

— · · — · · Other Class 57 Property or Class 58 Property

Figure 7.1-1: An example of an injection system for carbon storage in a geological formation.

Figure Text Description: Diagram illustrating the boundaries of a carbon storage process in a geological formation. The boundary begins at ST-3 where CO_2 exits a CO_2 transportation process, and includes equipment such as pumps, control skids and injection and monitoring wellheads. The boundary ends at ST-4 where the CO_2 passes into the injection well itself. For notes on process boundaries for this schematic, please refer to Section 7.2.

7.2 Process Boundary Notes on Schematics of Carbon Storage Processes

A key to the process boundary notes on the schematics is provided here and includes the definition of process boundaries for typical carbon storage processes.

ST-1 For descriptions of the Class 57 Property included within this process boundary, see Section 7.1.2 of this Guide.

ST-2 For descriptions of ineligible property that may be contained within this process boundary, see Section 7.1.3 of this Guide.

ST-3 The CO2 supply piping that is used by a carbon storage process is described in Class 57 paragraph (c) and the process boundary begins at, and includes, the first control valve that is used solely by property described in Class 57 paragraph (c), after an immediately upstream CO_2 purification and compression, carbon capture, direct air capture, or carbon transportation process and delineated at the point indicated by the terminal boundary for a CO_2 purification and compression process described in CSS-5, CS-4, DACS-5, or TS-4, respectively. Where there is no control valve as described above, the process boundary for the carbon storage process is the point where the piping for the CO2 supply system physically connects to the property described in Class 57 paragraph (c).

ST-4 The process boundary of the CO2 piping system that is used by a carbon storage process begins at the point indicated by ST-3 and ends where the piping reaches a CO2 injection wellhead.

ST-5 The schematic provides a general layout of typical valves, wells, and other equipment found within a CO2 injection system. However, the type and frequency of equipment will vary depending on each individual CO2 injection system. In general, the quantity of equipment will increase with the number of injection wells.

7.2.1 Class 57 Property Not Shown on the Schematic of Carbon Storage Processes

There are other property and systems ancillary to carbon storage processes that are not explicitly shown in the schematic but are still part of the CCUS process**.**

- The cooling system used by a carbon storage process is described in Class 57 paragraph (d) and includes piping and components that are used solely to deliver cooling fluid (e.g., cooling water, air, glycol) to and from the Class 57 Property. The carbon storage process boundary related to the cooling system begins at, and includes, the first control valve along the piping or ducting system that is used solely by the Class 57 Property and includes all piping or ducting downstream, up to and including the last control valve along the piping or ducting system that is used solely by the Class 57 Property. These points are located before and after the property described in Class 57 paragraph (c). If the whole cooling system is used solely by Class 57 Property, all piping and components are within the process boundaries of these processes. Otherwise, the carbon storage process boundary related to the cooling systems is the point where the piping for the cooling system physically connects to the property described in Class 57 paragraph (c).

- The utility air or nitrogen distribution system used by a carbon storage process is described in Class 57 paragraph (d) and includes piping and components that are used solely to supply utility air or nitrogen for the operation of equipment (e.g., pneumatic) and control systems (e.g., actuators) that is Class 57 Property. The carbon storage process boundary related to the utility air or nitrogen distribution system begins at, and includes, the first control valve along the piping system that is used solely by the Class 57 Property and includes all piping downstream, up to the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 57 paragraph (c). Otherwise, the carbon storage process boundary related to the utility air or nitrogen distribution system is the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 57 paragraph (c).
- The electrical system used by a carbon storage process is described in Class 57 paragraph (d) and includes wiring and components that are used solely to supply electrical energy for the operation of equipment that is Class 57 Property. The carbon storage process boundary related to the electrical system begins at, and includes, the first isolation switch along the wiring system that is used solely by the Class 57 Property and includes all wiring downstream, up to the point where the wiring for the electrical system physically connects to the property described in Class 57 paragraph (c). Otherwise, the carbon storage process boundary related to the electrical system is the point where the wiring for the electrical system physically connects to the property described in Class 57 paragraph (c).
- The power distribution system that supports a carbon storage process is described in Class 57 subparagraph (a)(iii) or subparagraph (a)(iv) in the definition of dual-use equipment and is not within the carbon storage process boundary. The carbon storage process boundary related to the power distribution system begins at the point where the power lines for the power distribution system physically connect to the property described in Class 57 paragraph (c).

The fuel supply system used by a carbon storage process is described in Class 57 paragraph (d) and includes piping and components used solely to deliver fuel to Class 57 Property. The carbon storage process boundary related to the fuel supply system begins at, and includes, the first control valve along the piping that is used solely by Class 57 Property and includes all piping up to the point where the piping physically connects to the property described in Class 57 paragraph (c).

8 Use Processes

8.1 Carbon Use in Concrete

8.1.1 Carbon Use in Concrete Processes

Carbon use in concrete processes use equipment to mix and/or pre-cast concrete for the purposes of permanent storage of captured carbon in concrete.

Property that is part of a carbon use in concrete process (described in Class 58 paragraph (a)), could be Class 58 Property if a number of conditions are met, including:

- the property is part of a CCUS project of a taxpayer; and
    - the property is to be used solely for using captured carbon in industrial production (including for enhanced oil recovery); or
    - the property is described in Class 58 paragraphs (b)-(e) in relation to the equipment described above.

The capital cost of Class 58 Property may be eligible for the CCUS tax credit if all eligibility requirements are met, as described in Section 1.4.1 of this Guide.

8.1.2 Pertinent Class 58 Property

Recognizing the variability in the CCUS process and its equipment configurations, whether a particular process is a CCUS process and whether particular property is Class 58 Property within a process where carbon use in concrete is the primary technology will be based on the definitions set out in the Act and the Regulations and determined by the Guide. The equipment described in this Section must meet the conditions of Section 8.1.1 to be Class 58 Property. The Guide is not exhaustive, and property may be evaluated on a case-by-case basis as needed. Examples of Class 58 Property could include, but are not limited to, the following:

- CO_2 supply and delivery systems (e.g., liquid CO_2 holding tanks, solenoid valves, insulated lines, tank fittings and injection nozzles) that are to be used solely for the injection of CO_2 into concrete mixing and curing vessels;
- CO_2 concrete curing autoclave and associated ancillary equipment (e.g., humidity/temperature control, mechanical vessel opening systems, pressure seals, racking, stationary loading and unloading equipment) that is to be used solely to cure — and therefore sequester — precast concrete using CO_2 as part of a CCUS process;
- CO_2 recovery equipment (e.g., compressors, vacuum pumps, knockout drums, air tanks, and filters) that is to be used solely for the collection and recycle of unreacted CO_2 from pressurized mixing and curing vessels;

- equipment located at a use site for unloading the CO_2 from trucks, rail tanks, barges, or ships:
    - Unloading equipment (e.g., articulated unloading arms, cryogenic hoses, cryogenic pumps, insulted pipelines, return lines from boil-off gas) for the purpose of transferring the CO_2 off the CO_2 transportation vessel; and
    - Pressure and temperature management equipment (e.g., vessel jackets, compressors, condensers, flash drums) to maintain the CO_2 at temporary storage conditions; and
- any other property that is described in Class 58 in relation to a carbon use process, including, but not limited to, ancillary equipment, monitoring and control equipment, and buildings or other structures listed in Sections 1.5.1.1, 1.5.1.2, and 1.5.1.3, respectively.

8.1.3 Typical Property Not Included in Class 58

Property used in the carbon use in concrete process that is not Class 58 Property is ineligible for the CCUS tax credit. Examples of typical property not included in Class 58 include the following:

- equipment that is used to manufacture the non-CO_2 components of concrete, including cement, aggregate, water, and supplementary cementitious materials (SCM), and is therefore not used solely for a CCUS process, such as:
    - equipment associated with the production of cement (e.g., ball or roller mills, pulverizers, kilns, cyclones, conveyors, filters, classifiers);
    - equipment associated with the production of aggregate or SCM (e.g., ball or roller mills, crushers, separators, collectors);
- equipment that is regularly required to manufacture concrete without CO_2 mineralization and is not used solely for the CCUS process (e.g., mixing vessels, extruders, shaping presses, conveyors, hoppers, bins, rail transport, truck transport), including water supply and distribution systems;
- equipment used to recycle waste products resulting from concrete manufacture (e.g., wash water collection bins, dewatering systems, settling tanks, classifiers, kilns);
- oil production equipment that is part of an enhanced oil recovery process; and
- trucks, vehicles, or other vessels that deliver or remove materials, consumables, and process waste from the CCUS process.

Please note, this list is not exhaustive and is meant to provide general guidance on property used commonly in a carbon use in concrete process that is not Class 58 Property.

Property that is part of a CCUS project of a taxpayer and that supports a carbon use in concrete process, described in Class 57 subparagraphs (a)(iii)-(v) of the Regulations and subparagraphs (a)(i)-(iv) in the definition of dual-use equipment in the Act, is not included in Class 58 but may be Class 57 Property or Dual-use Property. Please refer to Section 2.2 and Section 1.6 for more information on this property:

- generation equipment that generates electrical energy in support of a qualified CCUS project;

- distribution equipment that distributes electrical energy in support of a qualified CCUS project; and
- transmission equipment that transmits electrical energy in support of a qualified CCUS project.

8.1.4 Typical Capital Costs Included in Class 58

Typical capital costs when constructing a carbon use in concrete process that is part of a CCUS process would include the costs provided in Table 8.1-1:

Table 8.1-1 Project cost table for carbon use in concrete

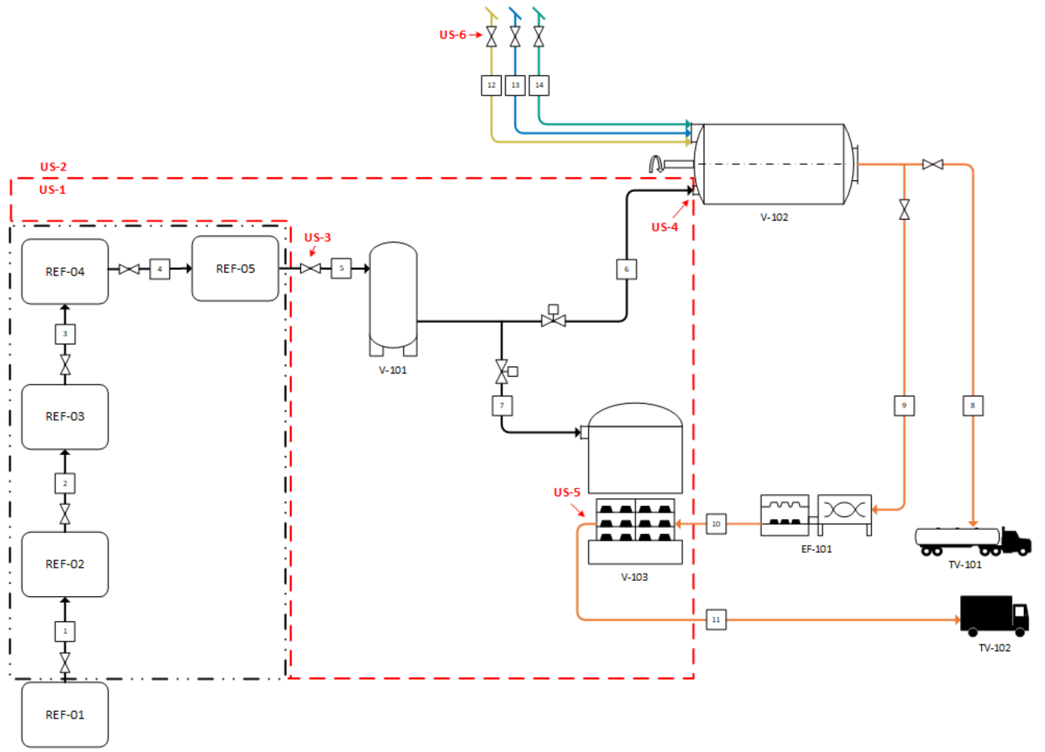
Capital cost of Class 58 Property generally means the taxpayer's full cost of acquiring the property and includes the expenditures listed in Section 1.4.3. These costs may be attributed to the following technical applications as part of carbon use in concrete process, provided the property is Class 58 Property such as, but not limited to, the Class 58 Property described in Section 8.1.2 or Section 1.5.1:	
1	CO_2 concrete mixing vessel injection equipment
2	CO_2 curing equipment, including dedicated unloading and loading systems
3	CO_2 supply, delivery, and recovery equipment
4	CO_2 liquefaction and regasification equipment
5	Unloading equipment for transfer of CO_2 from the transportation vessel to temporary storage.
6	Lab equipment required to verify the quality of the concrete and the degree of CO_2 uptake and that is to be used solely for this purpose
7	Electricity generation equipment – see Section 2.2 for details
8	Electricity distribution equipment – see Section 2.2 for details
9	Electricity transmission equipment – see Section 2.2 for details
10	Electrical system equipment
11	Utility cooling system equipment
12	Material handling and storage and distribution system equipment, including temporary CO_2 storage tanks, CO_2 return lines, and vapour and liquid pressure equalization lines
13	Venting system equipment
14	Process waste management system equipment
15	Compressed utility air or nitrogen system equipment
16	Complete monitoring and process control systems, including CO_2 monitoring and leak detection and air emissions monitoring equipment
17	Process safety equipment
18	Flow control and containment equipment
19	Buildings or other structures
20	Equipment for conversion of existing property into Class 58 Property
21	Equipment for refurbishment of existing Class 58 Property

8.1.5 Schematic for Class 58 Property in Carbon Use in Concrete Processes

Some typical elements of a CCUS process that can be used to store captured CO_2 through carbon use in concrete processes are shown in Figure 8.1-1. Process boundaries defined here are for a typical carbon use in concrete process, using a representative schematic as an example.

However, note that the specific property that is used in a carbon use in concrete process may depend on the specific application used in the CCUS process. Ultimately, whether particular property is Class 58 Property will depend on its function within the CCUS process. Note that equipment that is required for concrete production, such as the concrete mixer, is not Class 58 Property due to its dual-use in concrete production and carbon use in concrete.

NOTE: For keys to the process boundary notes on this schematic, please refer to Section 8.2.



Equipment Identifier	Equipment Type	Equipment Description
EF-101	Extruder / Former	Precast Concrete Moulding
TV-101	Transport Vehicle	Ready-Mix Transport from Plant
TV-102	Transport Vehicle	Precast Transport from Plant
V-101	Pressure Vessel	Liquid CO_2 Storage Tank
V-102	Mixer	CO_2-Concrete Mixer
V-103	Autoclave	CO_2 Precast Curing Autoclave

Stream Number	Stream Type
1	Raw CO_2
2	Pretreated CO_2
3	Captured CO_2
4	Compressed and Purified CO_2
5	Process Feed CO_2
6	Mixer CO_2 Injection Line
7	Curing CO_2 Injection Line
8	Ready-Mix to Transport
9	Precast Moulding Feed
10	Precast Blocks to Curing
11	Precast Blocks to Transport
12	Aggregate Feed
13	Water Feed
14	Cement Feed

Reference Identifier	Referenced Plant Section	Technical Guide Section(s)
REF-01	CO_2 Source Process	--
REF-02	Raw CO_2 Pre-Treatment	Section 2.1
REF-03	CO_2 Capture Process	Section 3
REF-04	CO_2 Compression and Purification	Section 2.3
REF-05	CO_2 Transportation	Section 6

Stream Legend

CO_2
Water
Cement
Aggregate
Concrete

Class 58 Property for a Concrete Carbon Storage Process

Other Class 57 Property

Figure 8.1-1: An example of a carbon use in concrete process.

Figure Text Description: Diagram illustrating the boundaries of a carbon use in a concrete process. The boundary begins at US-3 where CO_2 exits a CO_2 transportation process and includes equipment such as liquid CO_2 storage tank and CO_2 precast curing autoclave. The boundary ends at US-4 where CO_2 enters a CO_2-concrete mixer or US-5 where CO_2 enters a precast curing autoclave for concrete streams. For notes on process boundaries for this schematic, please refer to Section 8.2.

8.2 Process Boundary Notes on Schematics of Carbon Use Processes

A key to the process boundary notes on the schematics is provided here and includes the definition of process boundaries for typical carbon use processes.

US-1 For descriptions of the Class 58 Property included within this process boundary, see Section 8.1.2 of this Guide.

US-2 For descriptions of ineligible property that may be contained within this process boundary, see Section 8.1.3 of this Guide.

US-3 The CO_2 supply that is used by a carbon use process is described in Class 58 paragraph (a) and the process boundary begins at, and includes, the first control valve that is used solely by property described in Class 58 paragraph (a), after an immediately upstream CO_2 purification and compression, carbon capture, direct air capture, or carbon transportation process and delineated at the point indicated by the terminal boundary for a CO_2 purification and compression process described in CSS-5, CS-4, DACS-5, or TS-4, respectively. Where there is no control valve as described above, the process boundary for the carbon capture process is the point where the piping for the CO_2 supply system physically connects to the property described in Class 58 paragraph (a).

US-4 For ready-mix concrete with CO_2 mineralization, the process boundary of the CO_2 piping system that is used by the carbon use process begins at the point indicated in US-3 and ends at the port of the CO_2 piping system into the concrete mixing vessel, including the injection nozzle and control equipment.

US-5 For precast applications, the machinery used to remove the material from the CO_2 concrete curing vessel is not used solely for the Class 58 Property and the process boundary is; therefore, indicated by the outlet of the CO_2 concrete curing vessel and the machinery is not included in Class 58.

US-6 Material supply systems for aggregate, water, and cement to the concrete production process are outside the process boundary and are not included in Class 58.

8.2.1 Class 58 Property Not Shown on the Schematic of Carbon Use Processes

There are other property and systems ancillary to carbon use processes that are not explicitly shown in the schematic but are still part of the CCUS process.

- The utility air or nitrogen distribution system used by a carbon use process is described in Class 58 paragraph (b) and includes piping and components that are used solely to supply utility air or nitrogen for the operation of equipment (e.g., pneumatic) and control systems (e.g., actuators) that is Class 58 Property. The carbon use process boundary related to the utility air or nitrogen distribution system begins at, and includes, the first control valve along the piping system that is used solely by the Class 58 Property and includes all piping downstream, up to the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 58 paragraph (a). Otherwise, the carbon use process boundary related to the utility air or nitrogen distribution system is the point where the piping for the utility air or nitrogen distribution system physically connects to the property described in Class 58 paragraph (a).

- The electrical system used by a carbon use process is described in Class 58 paragraph (b) and includes wiring and components that are used solely to supply electrical energy for the operation of equipment that is Class 58 Property. The carbon use process boundary related to the electrical system begins at, and includes, the first isolation switch along the wiring system that is used solely by the Class 58 Property and includes all wiring downstream, up to the point where the wiring for the electrical system physically connects to the property described in Class 58 paragraph (a). Otherwise, the carbon use process boundary related to the electrical system is the point where the wiring for the electrical system physically connects to the property described in Class 58 paragraph (a).
- The power distribution system that supports a carbon use process is described in Class 57 subparagraph (a)(iii) or subparagraph (a)(iv) in the definition of dual-use equipment and is not within the carbon use process boundary. The carbon use process boundary related to the power distribution system begins at the point where the power lines for the power distribution system physically connect to the property described in Class 58 paragraph (a).

9 Knowledge Sharing

Qualified CCUS projects that are expected to incur qualified CCUS expenditures of $250 million or more over the life of the project based on the most recent project evaluation issued by the Minister of Natural Resources for the project or that have incurred $250 million or more of qualified CCUS expenditures before the ***first day of commercial operations*** of the project are required to contribute to public knowledge sharing in Canada.

To meet this expectation, the ***knowledge sharing taxpayer*** must submit a ***knowledge sharing report***, meaning a construction and completion knowledge sharing report to NRCan as well as five annual operations knowledge sharing reports that describe the project and its results, to be made available for public dissemination. Each completed knowledge sharing report must be submitted to NRCan by the ***reporting-due day***. If a report is considered incomplete *i.e.* does not adequately respond to all the required information, with meaningful and valid data, as per the Knowledge Sharing Report template or is not submitted by the reporting-due day, the knowledge sharing taxpayer is non-compliant and will receive a penalty of $2 million per report payable the day after the reporting-due day.

The construction and completion knowledge sharing report must be submitted to NRCan by the last day of the sixth month beginning after ***project start-up date***.

Five annual operations knowledge sharing reports are required. The first annual report must be submitted to NRCan by June 30 of the calendar year following the calendar year in which the project start-up date occurred, if the project start-up date is before October 1, or June 30 of the second calendar year following the calendar year in which the project start-up date occurred, if the project start-up date is after September 30. The remaining annual reports must be submitted by June 30 for the first four calendar years immediately following the calendar year which includes the June 30 on which the first annual report is due.

9.1 Construction and Completion Knowledge Sharing Report

The knowledge sharing taxpayer will be required to produce a construction and completion knowledge sharing report. The report will provide a general overview of the CCUS project to communicate its benefits, impact, and lessons learned to the public, as well as a more detailed section that communicates decision rationale, best practices, methods, and lessons learned to help other proponents looking to commission similar CCUS projects. The report must contain, but is not limited to, the following:

- knowledge sharing summary reporting as described in Section 9.1.1; and
- CCUS segment-specific reporting as described in Section 9.1.2.

9.1.1 Knowledge Sharing Summary Reporting

This section will provide a general overview of the project for the purpose of communicating the impact and benefits of the CCUS project to the public and other relevant stakeholders. Write in a format that could be easily disseminated on CCUS ITC webpage as a complete summary of the project (example, a .pdf file). This section will contain, but is not limited to, the following:

- *Executive Summary:* Provide a brief (1 page maximum) summary of this report.
- *Introduction:* Provide a brief overview of what the report contains and a brief description of the CCUS project and its scope, objectives, and purpose. Outline the project construction period, the important stakeholders, and the nature of involvement of any project partners that were involved in the CCUS project.
- *Background:* Provide background on the CCUS project, such as previous work this CCUS project has built upon, why it was needed, or the gap that needed to be addressed.
- *Description of Process and its Application:* Provide an overview of the CCUS project and CCUS process design, accompanied by a diagram or schematic of the CCUS process. Describe the impact of the CCUS project on the industry it is applied to. Provide technical details, such as the source and industry of the captured CO_2, including the method of transportation and the destination, as well as the measurement, monitoring, and verification system in place to ensure storage permanence.
- *Expected Results and Performance:* Provide a description of the key results that have been or will be achieved through the CCUS project. Provide these results in the context of Canada's greenhouse gas emission reduction milestone of 40-45% below 2005 levels in 2030 and the goal of net zero by 2050. Complete the provided table, indicating "not applicable" where appropriate:

	Key Indicator	**Value**
A	**Expected** annual CO_2 emissions generated by the source(s) of CO_2 to be captured (capture only)	tCO_2/year
B	**Expected** annual CO_2 emissions captured by the CCUS process (capture only)	tCO_2/year
C	**Expected** annual CO_2e emissions generated by the CCUS process	tCO_2e/year
D	**Expected** annual fugitive CO_2 emissions generated by the CCUS process	tCO_2/year
E	**Expected** annual net CO_2e emissions avoided (B – C – D) by the CCUS process	tCO_2e/year
F	**Expected** average thermal energy consumption by the CCUS process	GJ/tCO_2
G	**Expected** average electrical energy consumption by the CCUS process	MWh/tCO_2
H	**Expected** estimated average Scope 2* CO_2e emissions associated with thermal and electrical energy consumption by the CCUS process	tCO_2e/year
I	**Expected** average water consumption by the CCUS process	m^3_{water}/tCO_2

J	**Expected** average cost of CO_2 emissions captured by the CCUS process	$/t CO_2
K	**Expected** average cost of net CO_2e emissions avoided by the CCUS process	$/t CO_2e
L	**Expected** annual CO_2 stored using dedicated geological storage (if applicable)	t CO_2/year
M	**Expected** annual CO_2 stored in concrete (if applicable)	t CO_2/year
N	**Expected** annual CO_2 stored through other ineligible means (if applicable)	t CO_2/year
O	**Expected** average CO_2 stored in concrete (if applicable)	$tCO_2/t_{concrete}$

* Scope 2 emissions are those generated indirectly from the consumption of purchased energy (electricity, heating, and cooling)

- *Lessons Learned:* Provide a description of the lessons learned during the construction, commissioning, start-up, and initial operations of this CCUS project, such as a description of the challenges faced and how they were overcome, sector-specific considerations, best practices, any changes that occurred to the original project scope, and how the knowledge gained during the project can be leveraged for future CCUS projects.
- *Impacts and Monitoring:* Provide a description of the potential impacts of the CCUS project on the environment, specifying non-CO_2 emissions and substances released to the air, soil, and water. Summarize the measurement, monitoring, and verification approach for the CCUS project, the potential risks, and the preventative measures taken to mitigate those risks.
- *Benefits and Outcomes:* Provide a description of the benefits that have or will accrue as a result of the CCUS project. Provide a description of the project outcomes and their significance. Describe key areas where barriers to replication have been reduced due to this CCUS project and potential opportunities for replicability in Canada or internationally. Give an overview of the current or future revenue stream(s) generated as a result of this CCUS project. List the amount number of construction jobs and permanent jobs created as a result of this CCUS project.

Beyond this information, ITC recipients may share any additional information regarding the CCUS project for the purpose of knowledge sharing.

9.1.2 CCUS Segment-Specific Reporting

In addition to the summary reporting described above, the CCUS Tax Credit recipient is also responsible for sharing information related to the one or more CCUS value chain components that are present in the CCUS project. The applicable sections will depend on the scope of the CCUS project (i.e., capture only, transportation and storage hub, full value chain, etc.) This may require input from more than one project participant if the different segments (e.g., capture, transport, storage, and/or use) are the responsibility of different partners, but still part of the same CCUS project.

The purpose of this section is to communicate rationales, best practices, methodology, and lessons learned to other project developers looking to commission a CCUS project. This section will contain, but is not limited to, the topics listed below. The applicability of each section will depend on the scope of the CCUS project.

9.1.2.1 CCUS Project

These sections are to be completed by all CCUS projects that require Knowledge Sharing.

- *Project schedule:* Provide an overview of the project schedule, identifying timelines and milestones for different components as applicable (e.g., regulatory approvals, capture, transportation, storage). Describe challenges that arose during the project and lessons learned to reduce barriers and delays for future projects.
- *Stakeholder engagement:* List and summarize the stakeholders consulted during the project and identify any lessons learned.
- *Regulatory approvals:* List the standards and rules for the construction of the CCUS project, including identifying the regulatory body for each, the timeline for getting the approval, the relevant stage of the CCUS value chain, any challenges faced during the process, and lessons learned. Likewise, list all consents and permits for the construction of the CCUS project, including identifying the regulatory body for each, the timeline for getting the approval, any challenges faced during the process, and lessons learned.
- *Procurement:* Describe the procurement of the project technology, infrastructure, and services that were provided by Canadian vendors and businesses, along with justification for why international vendors or businesses were used in procurement. Estimate the proportion of the CCUS Project that was supplied by Canadian vendors and businesses.

9.1.2.2 Capture

These sections are to be completed by all CCUS projects that require knowledge sharing and where carbon capture is within their scope.

- *Pre-capture inlet conditions:* Provide the composition of the CO_2 stream coming into the upstream boundary of the process, as well as the temperature and pressure. Describe the source of the CO_2 stream.
- *Capture technology:* Provide a description of the capture technology along with the design rationale for the ultimate selection of the capture technology. Provide relevant performance metrics.
- *Regeneration process:* Provide a description of the regeneration method along with expected energy use for regeneration. Provide the design rationale for the heat integration scheme.
- *Purification and compression technology:* Provide the target pressure, temperature, and impurity levels of the CO_2 stream and the rationale for selecting the purification/dehydration technology.

- *Capture performance:* Provide an estimate of the expected CO_2 capture ratio based on estimated annual capture rate, and plant availability based on operational downtime. Provide justification for the estimated values.
- *Scale-up experience and approach:* Provide a description of the scale-up approach taken to arrive at the full-scale plant commissioned in the CCUS Project. Describe the approach taken to adapt any previous work to the site-specific capture facility in the CCUS Project.

9.1.2.3 Transportation

These sections are to be completed by all CCUS projects that require knowledge sharing and where carbon transportation is within their scope. This includes carbon capture projects where CO_2 is being transported from the carbon capture facility up to a tie-in point to a shared carbon transportation system or carbon storage or use projects where CO_2 is being transported from a shared carbon transportation system after a tie-in point to a carbon storage or carbon capture facility.

- *Transportation conditions:* Provide the phase of the transported CO_2, along with an overview of the required specifications (e.g., composition, impurity limits, water content), the capacity, and the operating conditions (operating temperature, pressure, mass flow rate)
- *General description of the transportation system:* Provide a general description of the transportation system along with a description of the internal/external coating materials and materials of construction, transportation route(s), number and location of stations across the system (loading/unloading stations, valve stations, booster stations, pigging stations, etc.), and number and location of valves and seal types. Provide the estimated pressure drop profile, risk analysis and leak detection system. Provide rationale for the selected transportation method.
- *Integrity management plan:* Provide a description of the integrity management plan to ensure the transportation system is operating safely, with regular maintenance and inspection. Provide the emergency response plan, company policy on transportation safety and maintenance, safety reporting and communication process, and information management process.

9.1.2.4 Storage

These sections are to be completed by all CCUS projects that require knowledge sharing and where carbon storage is within their scope.

- *Description of the storage site and injection conditions:* Summarize the location of the storage site and the general activities taking place at the injection site. Provide the conditions of the injection stream(s). Forecast the cumulative storage and the remaining storage over the lifetime of the CCUS Project.
- *Screening criteria:* Describe the storage site screening criteria used for selection, including a description of the type of geological formation, capacity, injectivity, pressure and temperature, containment, conflict with other subsurface users, impact of population density on site selection process, knowledge of well location, ability for monitoring, data access, etc.

- *Site selection:* Provide the justification for selecting the final site (e.g., geographical suitability, practical suitability, government regulations).
- *Site characterization:* Provide a description of the characterization activities for the selected site along with the data gathered during characterization, such as reservoir location, thickness, pressure, temperature, porosity, permeability, and injectivity. Provide an estimate of the storage capacity along with the methodology for estimating the capacity range. Give a general geological description of the target formation and the cap rock. Provide an overview of the lessons learned from the site screening, selection, exploration, and characterization activities.
- *Well design:* List each well along with a description of the type and purpose of each well (exploration, monitoring, injection, etc.). Provide the design rationale and lessons learned. Highlight any best practices.
- *Baseline monitoring results and tests:* Describe the monitoring techniques and lessons learned from measurements for monitoring soil, air, and groundwater aquifers; the injection horizon; and injectivity and draw down tests.
- *Risk assessment:* Detail the risk assessment, including the risks identified and a description of the corrective or preventative measures taken, as well as the justification for the measures from a cost-benefit analysis perspective.
- *Injection and operation:* Provide an overview of the assessment of the reservoir chemistry and its impact on injection, including reactivity of impurities and their impact on phase behaviour, as well as any risk or uncertainty in regard to the CO_2 stream composition and the subsurface. Outline the required pressure and temperature, as well as the pressure management and operation strategy. Summarize any lessons learned from this assessment.
- *Monitoring, measurement, and verification (MMV):* List and describe the monitoring techniques considered along with the screening and assessment process for the monitoring techniques and technologies, as well as justification for the ultimate selection based on cost-benefit analysis. Provide lessons learned from the assessment and selection process. Summarize the verification plan and reporting plan, highlighting areas of higher risk and specific monitoring targets and techniques for those areas.

9.1.2.5 Utilization

These sections are to be completed by all CCUS projects that require Knowledge Sharing and where carbon use is within their scope.

- *Utilization conditions:* Provide the required composition and the conditions of the CO_2 stream used in the utilization process.
- *Utilization process and technology:* Provide a description of the utilization technology and the material produced along with the design rationale for the technologies considered and the ultimate selection of the utilization process and technology. Provide an overview of the

utilization material and its performance such as CO_2 utilization efficiency, the estimated storage lifetime, and other material-specific performance metrics.

- *Utilization performance:* Provide an estimate of the expected CO_2 utilization ratio based on estimated annual utilization rate and plant availability based on operational downtime. Provide justification for the estimated values.
- *CO_2-derived material:* Provide a description of the utilization material produced along with an estimate of the carbon intensity of the material and the methodology for performing the calculation. Provide justification for the assumptions in the estimate.
- *Monitoring, measurement, and verification (MMV):* List and describe the monitoring techniques considered along with the screening and assessment process for the monitoring techniques and technologies, as well as justification for the ultimate selection based on cost-benefit analysis. Provide lessons learned from the assessment and selection process. Summarize the verification plan and reporting plan, highlighting areas of higher risk and specific monitoring targets, and techniques for those areas.

9.2 Annual Operations Knowledge Sharing Reports

The knowledge sharing taxpayer will also be required to produce five annual operations knowledge sharing reports. These reports will contain information related to the operation of the CCUS project to date (beginning from the project start-up date) and will communicate experience and lessons learned during CCUS project operation for the purpose of public knowledge sharing. These reports must contain, but are not limited to, the following:

- knowledge sharing summary reporting as described in Section 9.2.1; and
- CCUS segment-specific reporting as described in Section 9.2.2.

9.2.1 Knowledge Sharing Summary Reporting

	Key Indicator	Value
A	**Total** CO_2 emissions generated by the source(s) of CO_2 to be captured during the reporting year (capture only)	tCO_2
B	**Total** CO_2 emissions captured by the CCUS process during the reporting year (capture only)	tCO_2
C	**Total** CO_2e emissions generated by the CCUS project during the reporting year	tCO_2e
D	**Total** fugitive CO_2 emissions generated by the CCUS project during the reporting year	tCO_2

E	**Total** net CO_2e emissions avoided (B – C – D) by the CCUS process during the reporting year	tCO_2e
F	**Average** thermal energy consumption by the CCUS process during the reporting year	GJ/tCO_2
G	**Average** electrical energy consumption by the CCUS process during the reporting year	MWh/tCO_2
H	**Total** estimated Scope 2* CO_2e emissions associated with thermal and electrical energy consumption by the CCUS process during the reporting year	tCO_2e
I	**Average** water consumption by the CCUS process during the reporting year	m^3_{water}/tCO_2
J	**Average** cost of CO_2 emissions captured by the CCUS process during the reporting year	$\$/tCO_2$
K	**Average** cost of net CO_2e avoided by the CCUS process during the reporting year	$\$/tCO_2e$
L	**Total** CO_2 stored using dedicated geological storage during the reporting year (if applicable)	tCO_2
M	**Total** CO_2 stored in concrete during the reporting year (if applicable)	tCO_2
N	**Total** CO_2 stored through other ineligible means during the reporting year (if applicable)	tCO_2
O	**Average** CO_2 stored in concrete during the reporting year (if applicable)	$tCO_2/t_{concrete}$
P	**Cumulative** CO_2 emissions captured/transported/stored/used as a result of operating the CCUS process	tCO_2
Q	**Cumulative** net CO_2e avoided as a result of operating the CCUS project	tCO_2

* Scope 2 emissions are those generated indirectly from the consumption of purchased energy (electricity, heating, and cooling)

9.2.2 CCUS Segment-Specific Reporting

This section will contain, but is not limited to, the topics listed below. The applicability of each section will depend on the scope of the CCUS project.

9.2.2.1 CCUS Project

- *Performance challenges:* Provide a description of the performance challenges that impacted the performance metrics originally outlined for the CCUS Project. Give an overview of how these challenges were overcome or how the project was modified as a result of these challenges.
- *Knowledge sharing activities:* List any knowledge sharing events and activities (e.g., industry reports, webinars, conference presentations, panels, scientific articles) that resulted from this CCUS Project.

9.2.2.2 Capture

- *Capture performance:* Provide the actual CO_2 capture ratio based on the annual capture rate and plant availability.
- *Capture technology:* Provide the actual performance of the capture chemical for CO_2 removal efficiency, capacity to recover CO_2, and other relevant performance metrics.
- *Regeneration process:* Provide the actual energy use for the regeneration process and heat recovery efficiency.
- *Purification and compression technology:* Provide the actual performance metrics, including pressure, temperature, moisture, and impurity levels of the compressed CO_2 stream.
- *Operation experience and lessons learned:* Provide a description of lessons learned from the operation of the capture process, including any challenges that arose and best practices to overcome them.

9.2.2.3 Transportation

- *Transportation conditions:* Provide the actual operating conditions (e.g., pressure, temperature, mass flow rate, CO_2 stream composition).
- *Integrity management plan:* Provide a description of the ongoing integrity management plan to ensure the transportation system is operating safely, including any lessons learned or modifications made to the original plans based on operation.
- *Operation experience and lessons learned:* Provide a description of lessons learned from the operation of the transportation system, including any challenges that arose and best practices to overcome them.

9.2.2.4 Storage

- *Description of the storage site and injection conditions:* Provide the actual conditions of the injection stream(s), including composition of the stream(s), injection rate, rate and volume per well, and pressure at the wellhead and in the reservoir. Provide the historical storage and forecast the cumulative remaining storage over the lifetime of the CCUS Project.
- *Risk assessment:* Describe any events that triggered a re-assessment of storage risk. Provide details on the modifications made as well as the corrective or preventive measures taken to eliminate or minimize potential operational risks in the future.
- *Monitoring, measurement, and verification (MMV):* Describe the ongoing MMV efforts, the modifications made to the previous MMV plan, and any lessons learned from the operation of the process.

- *Operation experience and lessons learned:* Provide a description of lessons learned from the operation of the storage and injection site, including any challenges that arose and best practices to overcome them.

9.2.2.5 Utilization

- *Utilization performance:* Provide the actual amount of CO_2 permanently stored based on the utilization rate and the annual plant availability.
- *Utilization conditions:* Provide the actual composition and the conditions of the CO_2 stream used in the utilization process.
- *Utilization technology:* Provide the actual performance of the utilization process for CO_2 utilization efficiency, the estimated storage lifetime, and other material-specific performance metrics.
- *CO_2-derived material:* Provide the actual carbon intensity of the material produced from CO_2 utilization.
- *Monitoring, measurement, and verification (MMV):* Describe the ongoing MMV efforts, the modifications made to the previous MMV plan, and any lessons learned from the operation of the process.
- *Operation experience and lessons learned:* Provide a description of lessons learned from the operation of the utilization process, including any challenges that arose and best practices to overcome them.

10 Glossary of Useful Terms

Certain terms used in this Guide or within the project evaluation process are explained below. Terms in bold are included in subsection 127.44(1) or 211.92(1) of the Income Tax Act. Text quoted directly from the Act are written in italics.

Acid Gases	Gases produced as a result of natural gas processing that are composed of hydrogen sulfide (H_2S), carbon dioxide (CO_2), and similar acidic gases.
Acid Gas Injection	The process of injecting or disposing of acid gases (that were produced as a result of natural gas processing) into a suitable underground zone, similar to the ones used for water disposal during oil and gas drilling activities.
Amines	Organic chemical compounds containing one or more nitrogen groups as $-NH_2$, -NH, or -N groups, used as solvents in the CO_2 capture process to absorb CO_2 from the flue gas stream. The amines are heated to release high-purity CO_2 and the CO_2-free amines are then reused.
Biochar	A stable solid rich in carbon that is made from organic waste material or biomass that is partially combusted in the presence of limited oxygen. Biochar may provide long-term CO_2 storage, potentially offering carbon dioxide removal.
Brownfield Projects	Projects at sites where facilities already exist, meaning that the projects are executed at existing sites and only require construction of additional facilities directly related to the projects.
Captured Carbon	*Captured carbon means captured carbon dioxide that (a) would otherwise be released into the atmosphere or (b) is captured directly from the ambient air.*
Catalytic Conversion	A process for converting heavy hydrocarbons, chemicals, or fuels to light hydrocarbons, chemicals, or fuels through the use of catalysts.
CO_2-Source Process	The industrial process from which the raw CO_2 stream originates.
CCUS Factor	CCUS factor is a fraction between 0 and 1 that, when multiplied by the capital cost of Dual-use Property, determines the proportion of the capital cost of Dual-use Property that would be considered a qualified carbon capture expenditure.
CCUS Process	*A CCUS process means the process of carbon capture, utilization and storage that includes the (a) capture of carbon dioxide (i) that would otherwise be released into the atmosphere, or (ii) directly from the ambient air, and (b) storage or use of the captured carbon.*
CCUS Project	*A CCUS project means a project that is intended to support a CCUS process by (a) capturing carbon dioxide (i) that would otherwise be released into the atmosphere, or (ii) directly from ambient air; (b) transporting captured carbon; or (c) storing or using captured carbon.* A CCUS project may include one or more of the components listed above, provided it supports a CCUS process.
Chemical Absorption	Chemical absorption involves the reaction of CO_2 with a chemical solvent to form a weakly bonded intermediate compound which may be

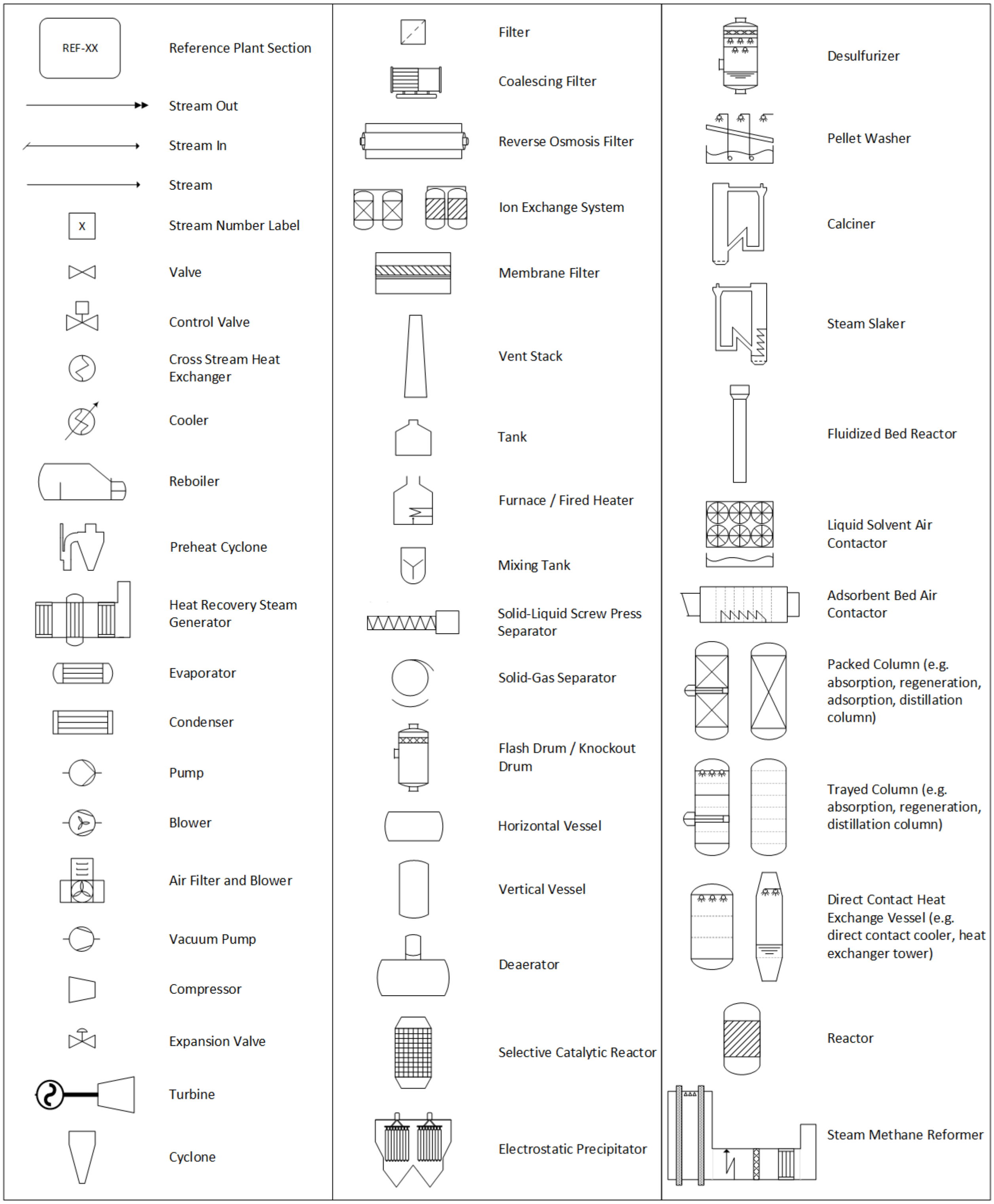
	regenerated with the application of heat, producing the original solvent and a CO_2 stream. Chemical absorption focuses on the reaction between the liquid absorbent, typically an aqueous solution of amines, and CO_2.
Class 57 Property	Property described in Class 57 in Schedule II of the Regulations.
Class 58 Property	Property described in Class 58 in Schedule II of the Regulations.
CO_2 Curing	The process of injecting CO_2 into a concrete mixture during curing, mineralizing the CO_2 through carbonation, and permanently embedding it in the concrete once hardened.
CO_2 Purification	The process of removing impurities such as water, particulates, hydrocarbons, and other gases from the CO_2 stream in order to prepare the CO_2 for transportation.
CO_2 Transport	The process of moving captured CO_2 via pipelines, ships, or rail to a suitable storage or CO_2-use site.
Dual-use Factor	Dual-use factor is a fraction between 0 and 1 that determines if certain property meets the energy generation or electrical energy transmission threshold of greater than 50% described in subparagraph (a)(i) and (a)(iii) in the definition of dual-use equipment, respectively. Property with a dual-use factor greater than 0.5 may be Dual-use Property.
Dual-Use Property	Property described in the definition of dual-use equipment in the Act.
Enhanced Oil Recovery (EOR)	The process of injecting gases (e.g., CO_2), heat, chemicals, or other extractants into oil reservoirs for the purpose of increasing the amount of oil recovered beyond primary (conventional) extraction.
Co-Generation	Cogeneration or combined heat and power is the use of a heat engine or power station to generate electricity and useful heat at the same time.
Dedicated Geological Storage	*Dedicated geological storage means a geological formation that is (a) located in a designated jurisdiction; (b) capable of permanently storing captured carbon; (c) authorized and regulated for the storage of captured carbon under the laws of the designated jurisdiction; and (d) a formation in which no captured carbon is used for enhanced oil recovery*.
Designated Jurisdiction	*Designated jurisdiction means (a) the provinces of British Columbia, Saskatchewan, and Alberta; and (b) any other jurisdiction within Canada (including the exclusive economic zone of Canada) or the United States for which a designation by the Minister of the Environment under subsection 127.44(13) of the Act is in effect.*
Eligible Use	*Eligible use means (a) the storage of captured carbon in dedicated geological storage; or (b) the use of captured carbon in producing concrete in Canada or the United States using a qualified concrete storage process.*
First Day of Commercial Operations	*First day of commercial operations means the day that is 120 days after the day on which captured carbon dioxide is first delivered to a carbon transportation, carbon storage or carbon use system for the purpose of storage or use on an ongoing operational basis.*
Flue Gases	Gases produced by combustion of a fuel that are normally emitted to the atmosphere. Common flue gas components are N_2, O_2, CO_2, H_2O, and Ar.

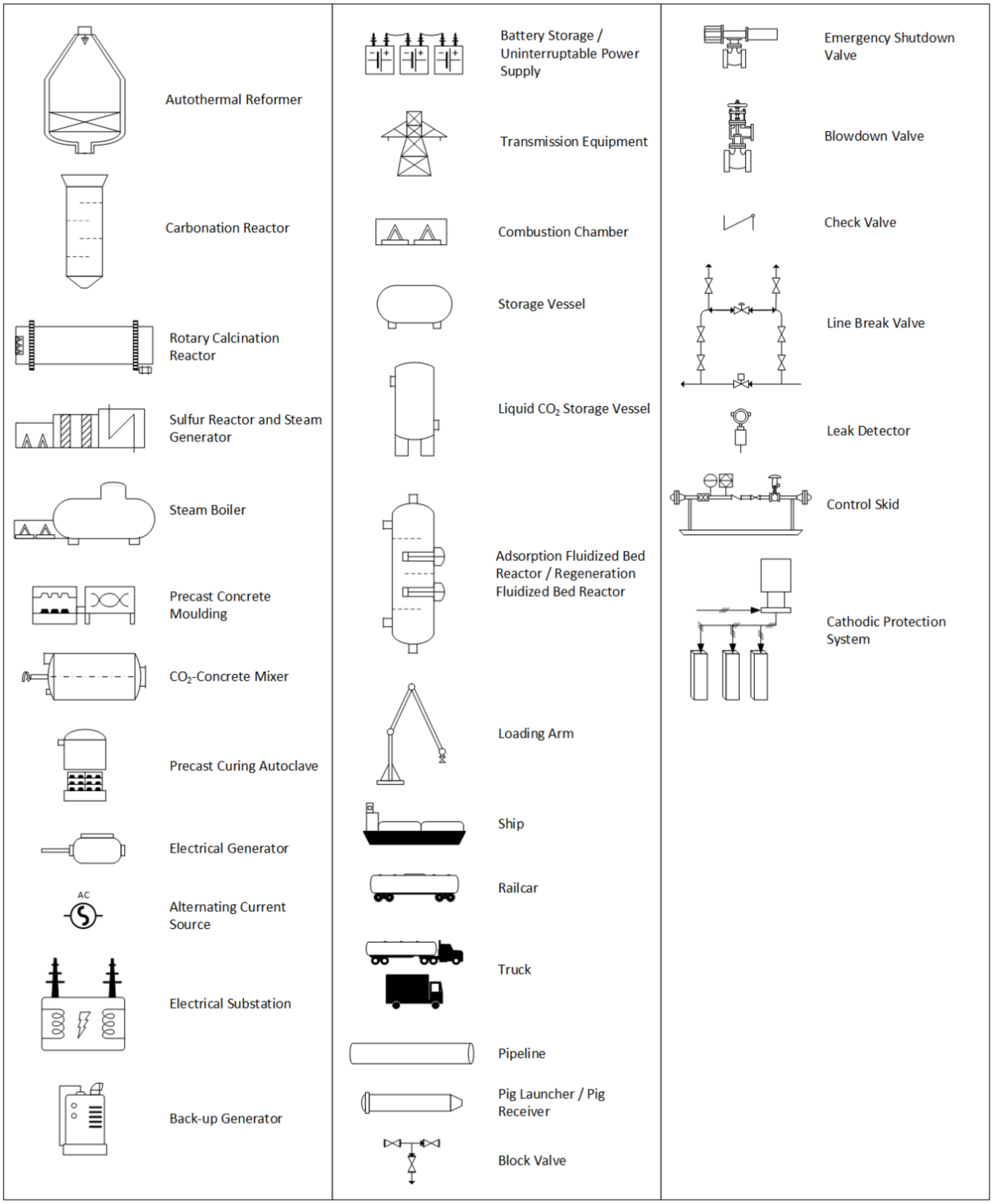
Greenfield Projects	Projects at sites where no facilities exist, meaning that the projects are executed at new sites and requires addition of all facilities needed to operate the projects.
Hydrocarbon Feedstock	A product or a combination of products derived from crude oil and destined for further processing.
Ineligible Use	*Ineligible use means (a) the emission of captured carbon into the atmosphere, other than(i) for the purposes of system integrity or safety, or (ii) incidental emission made in the ordinary course of operations; (b) the storage or use of captured carbon for enhanced oil recovery; and (c) any other purpose that is not an eligible use*.
Oxy-Fuel Combustion	The combustion of a fuel with pure oxygen or a mixture of oxygen, water, and carbon dioxide.
Physical Adsorption	When a gas is adsorbed on the surface of a solid by the weak intermolecular forces of attraction without the formation of any chemical bond between the adsorbate and the adsorbent, it is called physical adsorption.
Post-Combustion Capture	The capture of carbon dioxide after combustion.
Preliminary CCUS Work Activity	*Preliminary CCUS work activity means an activity that is preliminary to the acquisition, construction, fabrication or installation by or on behalf of a taxpayer of property that is described in Class 57 or 58 in Schedule II to the Income Tax Regulations or that is dual-use equipment in respect of the taxpayer's CCUS project including, but not limited to, a preliminary activity that is* *(a) obtaining permits or regulatory approvals; (b) performing front-end design or engineering work, including front-end engineering design studies (or equivalent studies as determined by the Minister of Natural Resources) but excluding detailed design or engineering work in relation to specific property included in Class 57 or Class 58; (c) conducting feasibility studies or pre-feasibility studies (or equivalent studies as determined by the Minister of Natural Resources); (d) conducting environmental assessments; or (e) clearing or excavating land.*
Pre-Combustion Capture	The capture of carbon dioxide by processing fuel before combustion.
Process Gases	Gases generated as a result of the chemistry in conversion processes that are normally emitted to the atmosphere.

Project Plan	*Project plan means a plan for a CCUS project that (a) reflects a front-end engineering design study (or an equivalent study as determined by the Minister of Natural Resources) for the CCUS project; (b) describes the quantity of captured carbon that the CCUS project is expected to support for storage or use in each calendar year over its total CCUS project review period, in (i) eligible use, and (ii) ineligible use; (c) contains information required in guidelines published by the Minister of Natural Resources; and (d) is filed with the Minister of Natural Resources, in the form and manner determined by that Minister, (i) before the project's first day of commercial operations, or (ii) if the project's first day of commercial operations occurs before the Minister of Natural Resources accepts plan filings, within 90 days after the first day on which such filings are accepted.*
Project start-up date	*Project start-up date means the day that is 120 days before the first day of commercial operations.*
Pyrolysis	The decomposition of a material at elevated temperatures in the absence of oxygen and within an inert environment. During methane pyrolysis, methane is decomposed into hydrogen and solid carbon.
Qualified CCUS Expenditure	*Qualified CCUS expenditure means a (a) qualified carbon capture expenditure; (b) qualified carbon transportation expenditure; (c) qualified carbon storage expenditure; or (d) qualified carbon use expenditure.*
Qualified Clean Hydrogen Project	*Qualified clean hydrogen project, as defined in subsection 127.48 (1) of the Act, means a clean hydrogen project of a taxpayer, as described in the taxpayer's clean hydrogen project plan, where the Minister of Natural Resources has confirmed in writing that (a) the hydrogen will be produced from an eligible pathway; (b) the expected carbon intensity contained in the taxpayer's most recent clean hydrogen project plan (i) is determined in accordance with subsection (6), and (ii) can reasonably be expected to be achieved based on the project design; and (c) if the project is intended to produce clean ammonia, the taxpayer has demonstrated (i) that the project can reasonably be expected to have sufficient hydrogen production capacity to satisfy the needs of the taxpayer's ammonia production facility, and (ii) if the taxpayer's hydrogen production facility and its ammonia production facility are not co-located, the feasibility of transporting hydrogen between the facilities.*
Qualified Concrete Storage Process	*Qualified concrete storage process means a process evaluated against the ISO 14034:2016 standard Environmental management — Environmental technology verification for which a validation statement confirming that at least 60% of the captured carbon that is injected into concrete is expected to be mineralized and permanently stored in the concrete has been issued by a professional or organization that (a) is accredited as a verification body, under ISO 14034:2016, Environmental management – Environmental technology verification and ISO/IEC 17020:2012, Conformity assessment — Requirements for the operation of various types of bodies performing inspection, by the Standards Council of Canada, the ANSI National Accreditation Board (U.S.) or any other accreditation organization that is a member of the International*

	Accreditation Forum; and (b) meets the requirements of a third-party inspection body described in ISO/IEC 17020:2012, Conformity assessment — Requirements for the operation of various types of bodies performing inspection.
Raw CO_2 Stream	Untreated gas stream to be treated by the CO_2 capture process. This stream may originate from combustion or industrial processes.
Solid CO_2 Adsorption	A process in which CO_2 is separated from other gases by accumulating on the surface of a solid as a result of physical or chemical attraction to the solid adsorbent's surface.
Solvent-Based CO_2 Absorption	A process in which CO_2 is separated from other gases by diffusing into a liquid solvent to form a solution as a result of physical or chemical attraction to the solvent.
Synthesis Gas	A mixture of carbon monoxide (CO) and hydrogen (H_2).
Thermochemical Conversion	Thermochemical processes that include pyrolysis, gasification, and liquefaction.
Total CCUS Project Review Period	*Total CCUS project review period, in respect of a CCUS project, means the period beginning on the first day of commercial operations of the project and ending on the last day of the **fourth project period**.*
Venting	Intentional or designed releases of greenhouse gas emissions that contain natural gas or hydrocarbon gas, including processes designed to flow to the atmosphere through seals or vent pipes, equipment blowdown for maintenance, and direct venting of gas used to power equipment.

11 Key to Symbols Used in Schematics




Autothermal Reformer
Carbonation Reactor
Rotary Calcination Reactor
Sulfur Reactor and Steam Generator
Steam Boiler
Precast Concrete Moulding
CO_2-Concrete Mixer
Precast Curing Autoclave
Electrical Generator
AC
Alternating Current Source
Electrical Substation
Back-up Generator
Battery Storage / Uninterruptable Power Supply
Transmission Equipment
Combustion Chamber
Storage Vessel
Liquid CO_2 Storage Vessel
Adsorption Fluidized Bed Reactor / Regeneration Fluidized Bed Reactor
Loading Arm
Ship
Railcar
Truck
Pipeline
Pig Launcher / Pig Receiver
Block Valve
Emergency Shutdown Valve
Blowdown Valve
Check Valve
Line Break Valve
Leak Detector
Control Skid
Cathodic Protection System