DEPARTMENT OF THE TREASURY

Internal Revenue Service

26 CFR Part 1

[TD 10023]

RIN 1545–BQ97

Credit for Production of Clean Hydrogen and Energy Credit

AGENCY: Internal Revenue Service (IRS), Treasury.

ACTION: Final regulations.

SUMMARY: This document contains final regulations implementing the credit for production of clean hydrogen and certain provisions of the energy credit as enacted by the Inflation Reduction Act of 2022. The regulations provide rules for: determining lifecycle greenhouse gas emissions rates resulting from hydrogen production processes; petitioning for provisional emissions rates; verifying production and sale or use of clean hydrogen; modifying or retrofitting existing qualified clean hydrogen production facilities; using electricity from certain renewable or zero-emissions sources to produce qualified clean hydrogen; and electing to treat part of a specified clean hydrogen production facility instead as property eligible for the energy credit. These regulations affect all taxpayers who produce qualified clean hydrogen and claim the clean hydrogen production credit, elect to treat part of a specified clean hydrogen production facility as property eligible for the energy credit, or produce electricity from certain renewable or zero-emissions sources used by taxpayers or related persons to produce qualified clean hydrogen.

DATES:

Effective date: These regulations are effective January 10, 2025.

Applicability dates: For dates of applicability, *see* §§ 1.45V–1(d), 1.45V–2(d), 1.45V–4(g), 1.45V–5(l), 1.45V–6(d), and 1.48–15(h).

FOR FURTHER INFORMATION CONTACT: Courtney Hutson at (202) 317–5319 or Alan Tilley at (202) 317–6512 (not toll-free numbers).

SUPPLEMENTARY INFORMATION:

Authority

This document contains final regulations that amend the Income Tax Regulations (26 CFR part 1) by adding regulations authorized to be issued by the Secretary of the Treasury or her delegate (Secretary) under sections 48 and 45V of the Internal Revenue Code (Code). The final regulations are issued under the authority granted under sections 45V(c)(1)(B), 45V(e)(5), 45V(f), 48(a)(15)(C), 48(a)(15)(E), 48(a)(16), 6001, and 7805(a) of the Code.

Section 45V(c)(1)(B) provides that lifecycle greenhouse gas emissions (lifecycle GHG emissions) shall only include emissions through the point of production (well-to-gate), as determined under the most recent Greenhouse gases, Regulated Emissions, and Energy use in Transportation model (commonly referred to as the ''GREET model'') developed by Argonne National Laboratory, or a successor model (as determined by the Secretary).

Section 45V(e)(5) directs the Secretary to issue regulations and guidance as she determines to be necessary to carry out the purposes of section 45V(e), which relates to the increased credit amount for qualified clean hydrogen production facilities that satisfy certain prevailing wage and apprenticeship requirements.

Further, section 45V(f) directs the Secretary to issue regulations or other guidance to carry out the purposes of section 45V, including for determining lifecycle GHG emissions.

Section 48(a)(15)(C) provides that the term ''specified clean hydrogen production facility'' means any qualified clean hydrogen production facility (as defined in section 45V(c)(3))(i) that is placed in service after December 31, 2022, (ii) with respect to which (I) no section 45V credit or section 45Q credit has been allowed, and (II) the taxpayer makes an irrevocable election to have section 48(a)(15) apply, and (iii) for which an unrelated third party has verified (in such form or manner as the Secretary may prescribe) that such facility produces hydrogen through a process that results in lifecycle GHG emissions that are consistent with the hydrogen that such facility was designed and expected to produce under section 48(a)(15)(A)(ii).

Section 48(a)(15)(E) directs the Secretary to issue such regulations or other guidance as she determines necessary to carry out the purposes of the section 48 energy credit, including regulations or guidance related to the recapture of such credit that exceeds the allowed amount ''if the expected production were consistent with the actual verified production (or all of the credit so allowed in the absence of such verification).''

Section 48(a)(16) directs the Secretary to issue regulations or other guidance as she determines necessary to carry out the purposes of the section 48 energy credit, including for recordkeeping or information reporting requirements necessary for the administration of the credit.

Section 6001 provides an express delegation of authority to the Secretary, stating that, ''[e]very person liable for any tax imposed by this title, or for the collection thereof, shall keep such records, render such statements, make such returns, and comply with such rules and regulations as the Secretary may from time to time prescribe. Whenever in the judgment of the Secretary it is necessary, [s]he may require any person, by notice served upon such person or by regulations, to make such returns, render such statements, or keep such records, as the Secretary deems sufficient to show whether or not such person is liable for tax under this title.''

These regulations are also issued under the express delegation of authority under section 7805(a), which provides that ''[t]he Secretary shall prescribe all needful rules and regulations for the enforcement of [the Code], including all rules and regulations as may be necessary by reason of any alteration of law in relation to internal revenue.''

Background

This document contains final regulations to implement the statutory provisions of sections 45V and 48(a)(15) of the Code, as enacted by section 13204 of Public Law 117–169, 136 Stat. 1818, 1935 (August 16, 2022), commonly known as the Inflation Reduction Act of 2022 (IRA).

The IRA added several provisions to the Code related to the production of, and investment in, clean hydrogen, which, along with the provisions of sections 45V and 48(a)(15), are described in part I of this Background section. Part II of this Background section describes a previous request for public comment on these provisions, and part III describes the proposed regulations promulgated under these provisions that the final regulations in this document adopt or modify as explained in the Summary of Comments and Explanation of Revisions.

I. IRA Provisions for Clean Hydrogen Production and Investment

This part I describes the credit for production of clean hydrogen as determined under section 45V (section 45V credit) and the irrevocable election to claim an energy credit under section 48 (section 48 credit) in lieu of the section 45V credit. Also described are statutory exceptions to the requirement that electricity be sold to an unrelated person to be eligible for the renewable electricity production credit determined

under section 45 (section 45 credit) or the zero-emission nuclear power production credit determined under section 45U (section 45U credit). Under these exceptions, electricity produced by a taxpayer from a qualified facility under section 45(d) or a qualified nuclear power facility under section 45U(b)(1) may be treated as sold by the taxpayer to an unrelated person during the taxable year if the electricity is used by the taxpayer or a related person at a qualified clean hydrogen production facility to produce qualified clean hydrogen.

A. Section 45V

1. Amount of Credit

Section 45V provides an income tax credit for the production of qualified clean hydrogen. For purposes of section 38, section 45V(a) provides that the clean hydrogen production credit for any taxable year is an amount equal to the product of (i) the kilograms of qualified clean hydrogen produced by the taxpayer during such taxable year at a qualified clean hydrogen production facility during the 10-year period beginning on the date such facility was originally placed in service, and (ii) the applicable amount as determined under section 45V(b) with respect to such hydrogen.

Section 45V(b)(1) provides that, for purposes of section 45V(a)(2), the applicable amount is an amount equal to the applicable percentage of $0.60. If the amount so determined is not a multiple of 0.1 cent, then such amount is rounded to the nearest multiple of 0.1 cent.

Section 45V(b)(2) provides that, for purposes of section 45V(b)(1), the applicable percentage is determined based on the lifecycle GHG emissions rate of the process used to produce any qualified clean hydrogen as follows: (i) if the lifecycle GHG emissions rate is not greater than 4 kilograms of carbon dioxide equivalent (CO_2e) per kilogram of hydrogen, and not less than 2.5 kilograms of CO_2e per kilogram of hydrogen, then the applicable percentage is 20 percent; (ii) if the lifecycle GHG emissions rate is less than 2.5 kilograms of CO_2e per kilogram of hydrogen, and not less than 1.5 kilograms of CO_2e per kilogram of hydrogen, then the applicable percentage is 25 percent; (iii) if the lifecycle GHG emissions rate is less than 1.5 kilograms of CO_2e per kilogram of hydrogen, and not less than 0.45 kilograms of CO_2e per kilogram of hydrogen, then the applicable percentage is 33.4 percent; and (iv) if the lifecycle GHG emissions rate is less than 0.45 kilograms of CO_2e per kilogram of hydrogen, then the applicable percentage is 100 percent.

Section 45V(b)(3) provides that the $0.60 amount in section 45V(b)(1) is adjusted by multiplying such amount by the inflation adjustment factor (as determined under section 45(e)(2), determined by substituting ''2022'' for ''1992'' in section 45(e)(2)(B)) for the calendar year in which the qualified clean hydrogen is produced. If any amount as increased under section 45V(b)(3) is not a multiple of 0.1 cent, such amount is rounded to the nearest multiple of 0.1 cent.[1]

Section 45V(e)(1) provides that, in the case of any qualified clean hydrogen production facility that satisfies the requirements of section 45V(e)(2), the amount of the section 45V credit with respect to qualified clean hydrogen described in section 45V(b)(2) is equal to the amount determined under section 45V(a) (determined without regard to section 45V(e)(1)) multiplied by five.

A qualified clean hydrogen production facility meets the requirements of section 45V(e)(2) if: (i) the facility began construction before January 29, 2023, and with respect to any taxable year, for any portion of such taxable year that is within the 10-year period beginning on the date the facility is originally placed in service, the prevailing wage requirements of section 45V(e)(3)(A) are met for any alteration or repair of the facility that occurs after January 29, 2023 (to the extent applicable);[2] or (ii) the facility satisfies the prevailing wage and apprenticeship (PWA) requirements of section 45V(e)(3)(A) and (4).[3]

Generally, the prevailing wage requirements under section 45V(e)(3)(A) with respect to any qualified clean hydrogen production facility require the taxpayer to ensure that any laborers and mechanics employed by the taxpayer or by any contractor or subcontractor in (i) the construction of such facility, and (ii) with respect to any taxable year, for any portion of such taxable year that is within the 10-year period beginning on the date such facility was originally placed in service, the alteration or repair of such facility, are paid wages at rates not less than the prevailing rates for construction, alteration, or repair of a similar character in the locality in which such facility is located as most recently determined by the Secretary of Labor, in accordance with subchapter IV of chapter 31 of title 40 of the United States Code, commonly known as the Davis-Bacon Act. Correction and penalty rules similar to the rules of section 45(b)(7)(B) also apply.

Section 45V(e)(4) provides that rules similar to the apprenticeship requirements of section 45(b)(8) apply for purposes of section 45V(e)(2)(B).[4]

For purposes of section 45V(a), in the case of a qualified clean hydrogen production facility that does not satisfy the requirements of section 45V(e)(2), the amount of the clean hydrogen production credit for any taxable year is $0.12, $0.15, $0.20, or $0.60 per kilogram of qualified clean hydrogen produced (before taking into account any inflation adjustment under section 45V(b)(3)), depending on the lifecycle GHG emissions rate associated with the facility's hydrogen production process. For facilities meeting the requirements of section 45V(e)(2), the credit amount determined under section 45V(a) (as adjusted for inflation subject to section 45V(b)(3)) is multiplied by five.

2. Definitions

a. Lifecycle Greenhouse Gas Emissions

Section 45V(c)(1)(A) provides that, subject to section 45V(c)(1)(B), the term ''lifecycle greenhouse gas emissions'' has the same meaning given such term under section 211(o)(1)(H) of the Clean Air Act (42 U.S.C. 7545(o)(1)(H)), as in effect on August 16, 2022. Under section 45V(c)(1)(B), the term ''lifecycle greenhouse gas emissions'' includes emissions only through the point of production (well-to-gate), as determined under the most recent Greenhouse gases, Regulated Emissions, and Energy use in Transportation model, referred to as the ''GREET model'' commonly and in this document, developed by Argonne National Laboratory, or a successor model as determined by the Secretary.

[1] The IRS will publish the inflation-adjusted section 45V applicable amount annually. The section 45V applicable amounts for calendar years 2023 and 2024 were published in Notice 2024–45, 2024–26 I.R.B. 1747.

[2] Section 45V(e)(3)(A)(ii) requires the payment of wages at prevailing rates ''with respect to any taxable year, for any portion of such taxable year which is within the period described in subsection (a)(2)'', with respect to the alteration or repair of the facility. There is no ''period described in subsection (a)(2).'' The Treasury Department and the IRS interpret the reference to ''subsection (a)(2)'' as a reference to section 45V(a)(1) where the 10-year credit period is identified.

[3] *See* §§ 1.45–7, 1.45–8, 1.45–12, and 1.45V–3, as published in the **Federal Register** (89 FR 53184) on June 25, 2024.

[4] Under § 1.45V–3, the PWA requirements for purposes of section 45V(e)(2)(B) are satisfied if a facility meets the prevailing wage requirements of section 45(b)(7) and § 1.45–7, the apprenticeship requirements of section 45(b)(8) and § 1.45–8, and the recordkeeping and reporting requirements of § 1.45–12. Those regulations are not a part of this Treasury decision and § 1.45V–3 is addressed only to the extent necessary for purposes of formatting the final regulations that are the subject of this decision in accordance with CFR standards.

b. Qualified Clean Hydrogen

Section 45V(c)(2)(A) provides that the term ''qualified clean hydrogen'' means hydrogen that is produced through a process that results in a lifecycle GHG emissions rate of not greater than 4 kilograms of CO2e per kilogram of hydrogen. Section 45V(c)(2)(B) further provides that the term ''qualified clean hydrogen'' does not include any hydrogen unless (i) such hydrogen is produced (A) in the United States (as defined in section 638(1) of the Code) or a United States territory (having the meaning of the term ''possession'' as defined in section 638(2)), (B) in the ordinary course of a trade or business of the taxpayer, and (C) for sale or use; and (ii) the production and sale or use of such hydrogen is verified by an unrelated party.

c. Provisional Emissions Rate

Section 45V(c)(2)(C) provides that, in the case of any hydrogen for which a lifecycle GHG emissions rate has not been determined for purposes of section 45V, a taxpayer producing such hydrogen may file a petition with the Secretary for a determination of the lifecycle GHG emissions rate with respect to such hydrogen, referred to as a ''provisional emissions rate'' or PER.

d. Qualified Clean Hydrogen Production Facility

Section 45V(c)(3) provides that the term ''qualified clean hydrogen production facility'' means a facility (i) owned by the taxpayer, (ii) that produces qualified clean hydrogen, and (iii) the construction of which begins before January 1, 2033.[5]

3. Special Rules

a. Treatment of Facilities Owned by More Than One Taxpayer

Section 45V(d)(1) provides that rules similar to the rules of section 45(e)(3) apply for purposes of section 45V. Section 45(e)(3) provides that, in the case of a facility in which more than one person has an ownership interest, except to the extent provided in regulations prescribed by the Secretary, production from the facility is allocated among such persons in proportion to their respective ownership interests in the gross sales from such facility.

b. Coordination With Section 45Q

Section 45V(d)(2) provides that no section 45V credit is allowed with respect to any qualified clean hydrogen produced at a facility that includes carbon capture equipment for which a credit is allowed to any taxpayer under section 45Q (section 45Q credit) for the taxable year or any prior taxable year.

c. Credit Reduced for Tax-Exempt Bonds

Section 45V(d)(3) provides that rules similar to the rules under section 45(b)(3) (credit reduced for tax-exempt bonds) apply for purposes of section 45V. Section 45V(d)(3) is effective for facilities that begin construction after August 16, 2022. *See* § 13204(a)(5)(B) of the IRA. Section 45(b)(3) provides that the amount of the credit determined under section 45(a) with respect to any facility for any taxable year (determined after the application of section 45(b)(1) and (2) regarding phaseout and inflation adjustment rules) is reduced by the amount that is the product of the amount so determined for such year and the lesser of 15 percent or a fraction (A) the numerator of which is the sum, for the taxable year and all prior taxable years, of proceeds of an issue of any obligations the interest on which is exempt from tax under section 103 and that is used to provide financing for the qualified facility, and (B) the denominator of which is the aggregate amount of additions to the capital account for the qualified facility for the taxable year and all prior taxable years. Section 45(b)(3) further provides that the amounts determined under section 45(b)(3) for any taxable year are determined as of the close of the taxable year.

d. Modification of Existing Facilities

Section 45V(d)(4) provides that for purposes of section 45V(a)(1), in the case of any facility that (A) was originally placed in service before January 1, 2023, and, prior to the modification described in section 45V(d)(4)(B), did not produce qualified clean hydrogen, and (B) after the date such facility was originally placed in service (i) is modified to produce qualified clean hydrogen, and (ii) amounts paid or incurred with respect to such modification are properly chargeable to the capital account of the taxpayer, such facility is deemed to have been originally placed in service as of the date the property required to complete the modification described in section 45V(d)(4)(B) is placed in service. Section 45V(d)(4) is effective for modifications made after December 31, 2022. *See* § 13204(a)(5)(C) of the IRA.

B. Electricity Used at a Qualified Clean Hydrogen Production Facility

Section 45(e)(13) provides that electricity produced by the taxpayer is treated as sold by such taxpayer to an unrelated person during the taxable year if (i) such electricity is used during such taxable year by the taxpayer or a person related to the taxpayer at a qualified clean hydrogen production facility (as defined in section 45V(c)(3)) to produce qualified clean hydrogen (as defined in section 45V(c)(2)); and (ii) such use and production is verified (in such form or manner as the Secretary may prescribe) by an unrelated third party. Section 45(e)(13) is effective for electricity produced after December 31, 2022. *See* § 13204(b)(3) of the IRA.

Section 45U(c)(2) provides that rules similar to the rules of section 45(e)(13) apply for purposes of section 45U. Generally, section 45U is effective for electricity produced at a qualified nuclear power facility and sold after December 31, 2023, in taxable years beginning after that date.

C. Election To Treat Clean Hydrogen Production Facilities as Energy Property

Section 48(a)(15)(A)(i) provides that, in the case of any qualified property (as defined in section 48(a)(5)(D)) that is part of a specified clean hydrogen production facility, such property is treated as energy property. Section 48(a)(15)(A)(ii) provides that the energy percentage of the basis of any qualified property that is treated as energy property is, for a facility that is designed and reasonably expected to produce qualified clean hydrogen with a lifecycle GHG emissions rate that is: (i) not greater than 4 kilograms of CO2e per kilogram of hydrogen, and not less than 2.5 kilograms of CO2e per kilogram of hydrogen, 1.2 percent; (ii) less than 2.5 kilograms of CO2e per kilogram of hydrogen, and not less than 1.5 kilograms of CO2e per kilogram of hydrogen, 1.5 percent; (iii) less than 1.5 kilograms of CO2e per kilogram of hydrogen, and not less than 0.45 kilograms of CO2e per kilogram of hydrogen, 2 percent; and (iv) less than 0.45 kilograms of CO2e per kilogram of hydrogen, 6 percent. Under section 48(a)(9), the amount of the section 48 credit determined for a specified clean hydrogen production facility under section 48(a)(15) is multiplied by five if the facility meets the requirements of section 48(a)(9)(B) (regarding application of certain maximum net

[5] Section 45V does not specify an earliest date on which a qualified clean hydrogen production facility must begin construction or be placed in service to be eligible for the section 45V credit. However, the section 45V credit is available for qualified clean hydrogen produced after December 31, 2022. *See* § 13204(a)(5)(A) of the IRA. Thus, the owner of a qualified clean hydrogen production facility originally placed in service after December 31, 2012, could claim the section 45V credit for qualified clean hydrogen produced during at least some portion of the 10-year period described in section 45V(a)(1), provided all other requirements are met.

output levels of electrical or thermal energy or prevailing wage and apprenticeship requirements). However, the domestic content and energy communities bonuses under section 48(a)(12) and (14) do not apply to a specified clean hydrogen production facility.

Section 48(a)(15) is effective for property placed in service after December 31, 2022, and for any property the construction of which began before January 1, 2023, only to the extent of the basis thereof attributable to construction, reconstruction, or erection after December 31, 2022. *See* § 13204(c)(3) of the IRA.

1. Denial of Production Credit

Section 48(a)(15)(B) provides that no section 45V credit or section 45Q credit is allowed for any taxable year with respect to any specified clean hydrogen production facility or any carbon capture equipment included at such facility.

2. Specified Clean Hydrogen Production Facility

Section 48(a)(15)(C) provides that the term ''specified clean hydrogen production facility'' means any qualified clean hydrogen production facility (as defined in section 45V(c)(3)) (i) that is placed in service after December 31, 2022, (ii) with respect to which (I) no section 45V credit or section 45Q credit has been allowed, and (II) the taxpayer makes an irrevocable election to have section 48(a)(15) apply, and (iii) for which an unrelated third party has verified (in such form or manner as the Secretary may prescribe) that such facility produces hydrogen through a process that results in lifecycle GHG emissions that are consistent with the hydrogen that such facility was designed and expected to produce under section 48(a)(15)(A)(ii).

3. Qualified Clean Hydrogen

Section 48(a)(15)(D) provides that, for purposes of section 48(a)(15), the term ''qualified clean hydrogen'' has the meaning given such term by section 45V(c)(2).

4. Regulations

Section 48(a)(15)(E) requires the Secretary to issue regulations or other guidance as she determines necessary to carry out the purposes of section 48, including regulations or other guidance that recaptures so much of any section 48 credit allowed as exceeds the amount of the credit that would have been allowed if the expected production were consistent with the actual verified production (or all of the credit so allowed in the absence of verification).

II. Notice 2022–58

On November 3, 2022, the Department of the Treasury (Treasury Department) and the IRS published Notice 2022–58, 2022–47 I.R.B. 483. The notice requested general comments on issues arising under section 45V and the associated clean hydrogen production and investment incentives in sections 45 and 48. The notice also requested specific comments concerning (i) definitions; (ii) boundaries of the well-to-gate analysis for determining the lifecycle GHG emissions rate; (iii) the PER process; (iv) recordkeeping and reporting; (v) verification by unrelated parties; and (vi) coordination with sections 45, 48, and 45Q. Stakeholders submitted more than 200 comments in response to Notice 2022–58, and those comments informed the development of the proposed regulations.

III. Proposed Regulations

On December 26, 2023, the Treasury Department and the IRS published proposed regulations under sections 45V and 48(a)(15) (REG–117631–23) in the **Federal Register** (88 FR 89220) to provide guidance on the credit for production of clean hydrogen and the energy credit, respectively (proposed regulations). The provisions of the proposed regulations are explained in greater detail in the preamble to the proposed regulations.

On April 11, 2024, the Treasury Department and the IRS published a supplemental notice of proposed rulemaking under sections 45V and 48(a)(15) in the **Federal Register** (89 FR 25551) inviting comments on the U.S. Department of Energy's (DOE) information collection related to the DOE's Emissions Value Request Process (EVRP) for use by applicants in obtaining an emissions value in support of a petition for a PER, as set forth in the proposed regulations. The EVRP is explained in greater detail in the supplemental notice of proposed rulemaking. On September 30, 2024, the DOE announced the opening of the EVRP. *See* Notice of Availability of the 45V Emissions Value Request Process (89 FR 80898).

Summary of Comments and Explanation of Revisions

This Summary of Comments and Explanation of Revisions summarizes the proposed regulations and all the substantive comments submitted in response to the proposed regulations. The Treasury Department and the IRS received approximately 30,000 written comments in response to the proposed regulations. The comments are available for public inspection at *www.regulations.gov* or upon request. A hearing was conducted in person and telephonically on March 25, 26, and 27, 2024, during which approximately 100 individuals testified.[6] After full consideration of the hearing testimony and the comments received, these final regulations adopt the proposed regulations with modifications in response to the comments described in this Summary of Comments and Explanation of Revisions.

The Treasury Department and the IRS also consulted extensively with scientific and technical experts from across the Federal government, including personnel from the DOE and the U.S. Environmental Protection Agency (EPA), in developing and drafting these final regulations. The Treasury Department and the IRS had regular meetings with these experts from the time that sections 45V and 48(a)(15) were enacted through the drafting and publication of the proposed regulations and the final regulations. The conclusions reached in these final regulations and explained in this Summary of Comments and Explanation of Revisions were deeply informed by the scientific and technical expertise that was shared by these experts.

Comments merely summarizing the proposed regulations, expressing generic, non-specific, or extraneous concerns, recommending statutory revisions to sections 45V, 48(a)(15), or other statutes, or addressing issues that do not pertain to the purposes of sections 45V and 48(a)(15) are not applicable to this rulemaking and are not adopted. Additionally, except to the extent discussed in this Summary of Comments and Explanation of Revisions, comments addressing the features of 45VH2–GREET or the contents of any supporting documentation to be provided in seeking an emissions value from the DOE are outside the scope of this

[6] A comment requested that the Treasury Department and the IRS (1) hold additional public hearings in, at a minimum, each of the seven regions where hydrogen hubs have been proposed; (2) provide virtual options for attending and presenting; and (3) clarify the process for participation at the public hearing. The Treasury Department and the IRS held a hearing over three days, which provided the public an opportunity to present testimony either in person or over the telephone. Individuals, whether testifying or not, could attend the hearing either in person or by telephone. Notice of the hearing was published as part of the proposed regulations in the **Federal Register** on December 26, 2023, which provided details to the public on how to participate. Accordingly, the public was provided a meaningful opportunity to participate in the hearing process.

rulemaking and therefore are not addressed herein.

I. General Rules and Definitions

Proposed § 1.45V–1 provided definitions of key terms used in proposed §§ 1.45V–1 through 1.45V–6 and 1.48–15, to determine eligibility for, and the amount of, the section 45V credit for production of clean hydrogen. Comments addressed several of the proposed definitions, as described in this part I.A of the Summary of Comments and Explanation of Revisions.

In addition, these final regulations add the new terms ''hydrogen gas stream,'' ''mixed gas or impurity,'' and ''productive use,'' which are discussed in part I.A.5 of the Summary of Comments and Explanation of Revisions, as well as the terms ''process'' and ''primary feedstock,'' which are discussed in part I.A.7. With respect to the definition of ''lifecycle GHG Emissions,'' the final regulations add a new rule for certain emissions related to purification treated as through the point of production, which is discussed in part I.A.6.d of the Summary of Comments and Explanation of Revisions. The final regulations renumber the definitions to incorporate the added definitions.

A. Definitions

1. Applicable Amount

Section 45V(b)(1) defines applicable amount, and section 45V(b)(3) provides the inflation adjustment that applies when calculating the applicable amount. Proposed § 1.45V–1(a)(2) would have adopted this definition and its related inflation adjustment provision. No comments addressed these provisions, and these final regulations adopt them as proposed.

2. Applicable Percentage

Section 45V(b)(2) defines the term ''applicable percentage.'' Proposed § 1.45V–1(a)(3) adopted this definition. No comments addressed this provision, and these final regulations adopt the definition as proposed.

3. Claim

Proposed § 1.45V–1(a)(4) would have provided that, with respect to the section 45V credit determined for qualified clean hydrogen produced by the taxpayer at a qualified clean hydrogen production facility, the term ''claim'' means the filing of a completed Form 7210, *Clean Hydrogen Production Credit,* or any successor form(s), with the taxpayer's Federal income tax return or annual information return for the taxable year in which the credit is determined, and includes the making of an election under section 6417 or section 6418 and the regulations thereunder, with respect to such section 45V credit on the applicable entity's or eligible taxpayer's timely filed (including extensions) Federal income tax return or annual information return.

One comment requested that the final regulations offer a streamlined process to claim the section 45V credit for small producers of hydrogen. Section 45V does not make any distinction based on the size of the hydrogen producer, and the importance of reporting and compliance are the same regardless of the producer's size. Accordingly, providing a more streamlined process for claiming the section 45V credit for small producers is not appropriate. Additionally, to clarify, section 1.45V–1(a)(4) has no effect on the procedures for making an election under section 6417 or 6418, the requirements for which are described in the regulations for each provision. For procedures for making an election under section 6417, see § 1.6417–2(b). For procedures for making an election under section 6418, see § 1.6418–2. Accordingly, section 1.45V–1(a)(4) is adopted without change.

4. Facility

a. Equipment Included in the Definition of Facility

Proposed § 1.45V–1(a)(7)(i) would have provided that, for purposes of the definition of qualified clean hydrogen production facility provided at section 45V(c)(3), the term ''facility'' means a single production line that is used to produce qualified clean hydrogen, unless otherwise specified. Further, proposed § 1.45V–1(a)(7)(i) would have provided that a ''single production line'' includes all components of property that function interdependently to produce qualified clean hydrogen. Components of property would be functionally interdependent if the placing in service of each component were dependent upon the placing in service of each of the other components to produce qualified clean hydrogen. Proposed § 1.45V–1(a)(7)(iii) would have provided that components that have a purpose in addition to the production of qualified clean hydrogen may be part of a facility if such components function interdependently with other components to produce qualified clean hydrogen. Proposed § 1.45V–1(a)(7)(iv) would have provided an example to illustrate the definition of facility for purposes of section 45V.

Comments asked a variety of questions about the definition of ''facility,'' including whether specific equipment is part of a facility. Some comments requested clarification on the meaning of ''single production line'' and ''functional interdependence'' and whether components of a facility that produce hydrogen as a by-product of another production process are part of a ''single production line'' that is used to produce hydrogen. Other comments asked for clarification on whether designated spaces and equipment necessary for commercial operation, but not necessary for hydrogen production (for example, break rooms and lighting) are part of the ''facility.'' Another comment requested that the final regulations specify a method for allocating lifecycle GHG emissions across multipurpose components. The comment suggested that, in many cases, it would not be appropriate to include, through the point of production, all lifecycle GHG emissions from multipurpose components that are part of the balance of plant, such as the cooling tower or air compressor if the hydrogen production process does not consume a significant amount of energy from the use of such equipment.

One comment recommended that the final rules modify the definition of ''facility'' to include all electrolyzers within the balance of plant to prevent hydrogen producers from designating one electrolyzer as having produced hydrogen without energy attribute certificates (EACs) should a producer not have EACs sufficient to ensure all hydrogen produced at a facility is qualified clean hydrogen.

Another comment asked whether the definition of ''facility'' in proposed § 1.45V–1(a)(7) would create a ''circular loop'' wherein the hydrogen producer would need to identify the components of the facility in order to obtain an emissions rate under 45VH2–GREET, but could not identify the components of the facility without knowing whether the facility produces hydrogen at an emissions rate of not greater than 4 kilograms of CO2e per kilogram of hydrogen.

One comment requested clarification that the definition of facility in proposed § 1.45V–1(a)(7) does not apply for purposes of the definition of ''industrial facility'' in § 1.45Q–2(d).

One comment requested clarification on whether a facility includes downstream property that uses the hydrogen produced at a qualified clean hydrogen production facility. Similarly, one comment requested clarification on whether hydrogen production equipment that is installed on the property of an industrial plant or a gas utility qualifies as a ''facility.'' Although

unclear, this comment appears to be requesting clarification whether an existing industrial plant or gas utility becomes a hydrogen production facility if hydrogen production equipment is added to the existing plant or utility.

In response to these comments seeking clarification on what is included in the definition of facility, these final regulations modify proposed § 1.45V–1(a)(7)(i) and (iv), as well as § 1.45V–1(a)(7)(ii), which identifies equipment that is not included in the definition of facility. Generally, the definition of ''facility'' is sufficiently clear as an established tax concept. The concept of ''functional interdependence'' has been used by courts for many years to decide whether property was placed in service for depreciation and the investment tax credit. *See, for example, Armstrong World Industries, Inc.* v. *Commissioner,* 974 F.2d 422, 434 (3d Cir. 1992) (''[C]ourts appear to agree that individual components will be considered as a single property for tax purposes—when the component parts are functionally interdependent when each component is essential to the operation of the project as a whole and cannot be used separately to any effect.''). The general definition of facility in proposed § 1.45V–1(a)(7)(i) uses this ''functional interdependence'' concept by indicating that a single production line includes all components of property that function interdependently to produce qualified clean hydrogen. To ease the determination of what equipment is included, the final regulations add to this definition the phrase ''through a process that results in the lifecycle GHG emissions rate used to determine the credit.'' This clarifies that all equipment used to produce the qualified clean hydrogen for which the section 45V credit is determined is included as part of the qualified clean hydrogen facility. For example, carbon capture equipment is part of the facility if it contributes to the lifecycle GHG emissions rate of the process by which the qualified clean hydrogen for which the credit is determined is produced. In addition, these final regulations update the example in § 1.45V–1(a)(7)(iv) to reflect the modifications made to the text in § 1.45V–1(a)(7)(i).

Purification equipment is part of the facility if such equipment contributes to the purity content of the qualified clean hydrogen for which the section 45V credit is determined. As discussed in part I.A.6.c of this Summary of Comments and Explanation of Revisions, purification equipment that is used downstream of the facility's process of producing qualified clean hydrogen is not part of the facility, but in certain circumstances, emissions from such purification equipment are within the well-to-gate system boundary for purposes of the lifecycle GHG emissions rate analysis.

Regarding multipurpose components, these final regulations adopt proposed § 1.45V–1(a)(7)(iii) with a clarification that production is for qualified clean hydrogen. Proposed § 1.45V–1(a)(7)(iii) already clarifies that components can have multiple purposes, including but not limited to the production of qualified clean hydrogen, so long as the components function interdependently with other components to produce qualified clean hydrogen. With respect to the allocation of lifecycle GHG emissions attributed to multipurpose components, taxpayers must use a reasonable method to allocate the inputs used to determine such emissions.

To the extent a facility produces hydrogen as a by-product of another production process, any components of the facility that function interdependently to produce qualified clean hydrogen—regardless of whether they serve a purpose in addition to the production of qualified clean hydrogen—are part of the qualified clean hydrogen production facility.

With respect to whether equipment necessary for commercial operation, but not for hydrogen production, is part of the ''facility'' (such as break room lighting), § 1.45V–1(a)(7)(i) answers this question. If the placing in service of such equipment is not necessary to produce qualified clean hydrogen and is not part of the process that results in the lifecycle GHG emissions rate used to determine the credit, such equipment does not function interdependently with the qualified clean hydrogen production equipment and is not part of the ''facility.'' If such non-functionally interdependent equipment draws from the same electricity source as the facility, to the extent it is separately metered, such electricity usage would not be an input into 45VH2–GREET. To the extent such equipment is not separately metered, taxpayers must use a reasonable method to allocate such electricity usage.

The final regulations do not adopt the comment to revise the definition of ''facility'' to include all electrolyzers within the balance of plant. Under § 1.45V–1(a)(7)(i), to the extent each electrolyzer produces qualified clean hydrogen separately from the other electrolyzers (that is, does not function interdependently with the other electrolyzers), each electrolyzer is treated as a separate facility. Treating each electrolyzer within the balance of plant as a separate facility is consistent with Revenue Ruling 94–31, 1994–1 C.B. 16, which held that each wind turbine within a windfarm is a separate ''qualified facility'' under section 45 because each wind turbine can be separately operated and metered to produce electricity. Similar to a wind turbine within a wind farm, an electrolyzer within the balance of plant functions separately from the other electrolyzers to produce hydrogen. As to the concern that EACs may be shifted from one electrolyzer to another electrolyzer within the balance of plant, a hydrogen producer is free to acquire and retire EACs for some electrolyzers and not for others, no matter the production technology the electrolyzers use and no matter the extent of their co-location, so long as the retired EACs are matched to a particular electrolyzer's electricity consumption from which hydrogen is produced. Imposing a rule that co-located electrolyzers are considered part of the same facility so that they each receive an equal allocation of EACs would not necessarily reflect each electrolyzer's electricity consumption and would be inconsistent with existing tax law's treatment of the definition of ''facility.''

In response to the comment that questioned whether the definition of ''facility'' in § 1.45V–1(a)(7) creates a ''circular loop,'' these final regulations modify proposed § 1.45V–1(a)(7)(i) to provide that equipment is part of the facility if it functions interdependently to produce qualified clean hydrogen through a process that results in the lifecycle GHG emissions rate used to determine the credit. The lifecycle GHG emissions analysis of the hydrogen production process is not coextensive with the tax definition of a hydrogen production facility. For example, lifecycle GHG emissions include emissions from stages of the hydrogen production process beyond the hydrogen production facility, such as emissions from growth, gathering, extraction, processing, and delivery of feedstock to a hydrogen production facility. *See* section 45V(c)(1)(A) (defining lifecycle GHG emissions by reference to section 211(o)(1)(H) of the Clean Air Act) and (B) (describing that lifecycle GHG emissions include emissions through the point of production (well-to-gate)); see also *Guidelines to Determine Well-to-Gate Greenhouse Gas (GHG) Emissions of Hydrogen Production Pathways using 45VH2–GREET* (45VH2–GREET User Manual), § 2.4.1 (Emissions of Electricity Generation), which can be

found at *www.energy.gov/45vresources.* The Summary of Comments and Explanation of Revisions to these final regulations generally refer to the 45VH2–GREET User Manual as it is currently publicly available, but at times references intended modifications to it. As further discussed in the Summary of Comments and Explanation of Revisions to these final regulations, the DOE intends to release a new version of 45VH2–GREET with an accompanying user manual in January 2025.

Regarding whether a ''facility'' includes downstream property that uses hydrogen produced at a qualified clean hydrogen production facility, downstream property that does not contribute to the facility's process of producing qualified clean hydrogen—but instead only to the later use of such hydrogen following its production—is not part of the facility because it does not function interdependently in the production of the qualified clean hydrogen for which the section 45V credit is determined. Further, § 1.45V–1(a)(7)(ii) provides that the facility does not include equipment used to condition or transport hydrogen beyond the point of production.

Regarding the effect of § 1.45V–1(a)(7) on the definition of industrial facility under § 1.45Q–2(d), whether and the extent to which the section 45V regulations affect terms defined in section 45Q is a matter that falls within the scope of section 45Q and is therefore not applicable to these regulations.

Regarding whether an industrial plant or gas utility becomes part of the hydrogen production ''facility'' when hydrogen production equipment is installed at the plant or utility, such an inquiry will depend on the facts and circumstances of the particular hydrogen production equipment and whether such equipment functions interdependently with the existing industrial plant or utility equipment to produce hydrogen. Accordingly, these final regulations provide sufficient criteria to apply to such an inquiry on a case-by-case basis.

b. Equipment Excluded From the Definition of Facility

Proposed § 1.45V–1(a)(7)(ii) would have provided that a facility does not include equipment used to condition or transport hydrogen beyond the point of production. Proposed § 1.45V–1(a)(7)(ii) also would have provided that a facility does not include electricity production equipment used to power the hydrogen production process, including any carbon capture equipment associated with the electricity production process.

Some comments requested clarification that a ''facility'' does not include upstream facilities that generate and supply electricity, fuel, feedstock, water, ammonia, or other inputs into or for use at the hydrogen production facility. Another comment requested confirmation that a facility producing renewable natural gas (RNG) that is supplied to a facility that uses the RNG to produce hydrogen does not fall within the definition of ''facility.''

One comment recommended that the final rules exclude from the definition of ''facility'' any facility that includes an electrolyzer stack that was assembled in or by a ''Covered Nation'' as defined in 10 U.S.C. 4872(d)(2), or a ''Foreign Entity of Concern,'' as referenced under § 40207 of the Infrastructure Investment and Jobs Act, Public Law 117–58.

The Treasury Department and the IRS agree that clarification is needed on whether feedstock production equipment is part of the ''facility.'' In addition, clarification is needed on whether feedstock recovery equipment is part of the ''facility.'' Although proposed § 1.45V–1(a)(7)(ii)(B) would have excluded electricity production equipment from the definition of ''facility,'' the proposed rules would not have addressed other types of feedstock production and recovery equipment, such as RNG production equipment. The intent of the proposed rules was to exclude upstream feedstock production and recovery equipment, such as RNG production equipment, from the definition of facility. Accordingly, these final regulations add ''feedstock-related equipment, including production, purification, recovery, transportation, or transmission equipment'' to the list of items excluded from the definition of facility in § 1.45V–1(a)(7)(ii)(B). As discussed in this part I.A.6.c of this Summary of Comments and Explanation of Provisions, however, lifecycle GHG emissions associated with feedstock growth, gathering, extraction, processing, and delivery to a hydrogen production facility are still included in the lifecycle GHG analysis reflected in 45VH2–GREET.

As to excluding components assembled in or by a ''Covered Nation'' or a ''Foreign Entity of Concern'' from the definition of facility, there is no provision of section 45V that imposes such a rule, so these final regulations do not adopt this comment.

5. Hydrogen Gas Stream, Mixed Gas or Impurity, and Productive Use

The final regulations add three new definitions, ''hydrogen gas stream,'' to § 1.45V–1(a)(8); ''mixed gas or impurity,'' to § 1.45V–1(a)(10); and ''productive use'' to § 1.45V–1(a)(12). The term ''hydrogen gas stream'' means a flow of gases that includes hydrogen, either alone or with one or more other gases. The term ''mixed gas or impurity'' means a non-hydrogen gas that is part of a hydrogen gas stream.

The term ''productive use'' means, with respect to a hydrogen gas stream, a consumption of the hydrogen gas stream in a manner that generates positive economic value, which is determined without regard to the availability of the section 45V credit. The term ''productive use'' means, with respect to qualified clean hydrogen, a consumption of qualified clean hydrogen in a manner that generates positive economic value, which is determined without regard to the availability of the section 45V credit. Positive economic value is determined without regard to the section 45V credit, consistent with the anti-abuse rule of § 1.45V–2(b). Thus, for example, a hydrogen gas stream produced with the primary purpose of obtaining the benefit of the section 45V credit in a wasteful manner would not have a productive use.

All three terms are relevant to the rule where certain emissions related to purification are treated as through point of production, described in part I.A.6.d of this Summary of Comments and Explanation of Revisions. The term ''productive use'' also relates to the anti-abuse rule described in part II.B of this Summary of Comments and Explanation of Revisions.

6. Lifecycle GHG Emissions

Section 45V(c)(1)(A) provides that, subject to section 45V(c)(1)(B), the term ''lifecycle greenhouse gas emissions'' has the same meaning given such term under section 211(o)(1)(H) of the Clean Air Act (42 U.S.C. 7545(o)(1)) as in effect on the date of enactment of section 45V. Section 45V(c)(1)(B) provides that the term ''lifecycle greenhouse gas emissions'' only includes emissions through the point of production (well-to-gate), as determined under the most recent GREET model, or a successor model (as determined by the Secretary). Proposed § 1.45V–1(a)(8) would have defined ''lifecycle GHG emissions.'' The final regulations renumber proposed § 1.45V–1(a)(8) to § 1.45V–1(a)(9).

Proposed § 1.45V–1(a)(8)(i) would have incorporated the statutory definitions provided in section 45V(c)(1)(A) and (B), specifically providing that the term has the same meaning as that in section 211(o)(1)(H) of the Clean Air Act as in effect on August 16, 2022, and includes

emissions only through the point of production (well-to-gate) as determined under the most recent GREET model, or a successor model. These final regulations modify proposed § 1.45V–1(a)(8)(i) to provide that, for purposes of section 45V, lifecycle GHG emissions are determined under the 45VH2–GREET Model. No comments were received on § 1.45V–1(a)(8)(i), and this provision is adopted as renumbered § 1.45V–1(a)(9)(i) without further changes.

By reference to section 211(o)(1)(H) of the Clean Air Act, section 45V(c)(1)(A) requires a complete assessment of direct and significant indirect emissions associated with a hydrogen production process. After consultation with the DOE and the EPA, the Treasury Department and the IRS interpret section 45V(c)(1)(A) with its reference to section 211(o)(1)(H) of the Clean Air Act as excluding emissions related to the manufacturing of the equipment within the hydrogen production pathway (for example, power generators, hydrogen production facility), from the definition of lifecycle GHG emissions. This interpretation is consistent with how EPA has implemented section 211(o)(1)(H) of the Clean Air Act for the Renewable Fuel Standard (RFS) program.[7]

a. Most Recent GREET Model

Proposed § 1.45V–1(a)(8)(ii) would have provided that, for purposes of the section 45V credit, the term ''most recent GREET model'' means the latest version of 45VH2–GREET developed by Argonne National Laboratory and published by the DOE, as provided in the instructions to the latest version of Form 7210, *Clean Hydrogen Production Credit,* or any successor form(s), on the first day of the taxable year during which the qualified clean hydrogen for which the taxpayer is claiming the section 45V credit was produced. Proposed § 1.45V–1(a)(8)(ii) would have further provided that, if a version of 45VH2–GREET becomes publicly available after the first day of the taxable year of production (but still within such taxable year), then the taxpayer could, in its discretion, treat such later version of 45VH2–GREET as the most recent GREET model.

Several comments recommended changes to proposed § 1.45V–1(a)(8)(ii). Some comments requested that, instead of identifying 45VH2–GREET as the ''most recent GREET model'' under section 45V(c)(1)(B), the final regulations identify the R&D GREET model developed by Argonne National Laboratory and published by the DOE as the most recent GREET model. Comments further recommended that the final regulations require the use of 45VH2–GREET as a ''successor model'' only if 45VH2–GREET closely aligns in function and principle with the version of the R&D GREET model as it existed at the time that section 45V was enacted. Other comments supported 45VH2–GREET as the best available open-source lifecycle analysis methodology for determining lifecycle GHG emissions for purposes of section 45V. Yet another comment recommended that a model the comment had developed should be able to be used as an alternative to 45VH2–GREET.

Except for changing the nomenclature of the ''most recent GREET model'' to the ''45VH2–GREET Model,'' as further discussed in this part I.A.6.a of the Summary of Comments and Explanation of Revisions, these final regulations do not adopt the comments recommending changes to proposed § 1.45V–1(a)(8)(ii).

Though the Treasury Department and the IRS continue to view 45VH2–GREET as the most recent GREET model for the reasons described in the preamble to the proposed regulations and the fact that it was developed more recently than the R&D GREET model, the Treasury Department and the IRS recognize that the continued existence of the R&D GREET model and periodic updates to both 45VH2–GREET and the R&D GREET model have created some uncertainty in this regard. To avoid any potential uncertainty about the meaning of the most recent GREET model, which would be detrimental to the administration and implementation of the section 45V credit, the Secretary is invoking her express delegation of authority in section 45V(c)(1)(B) to determine 45VH2–GREET to be a ''successor model'' and to require its use.

In selecting 45VH2–GREET rather than the R&D GREET model or some other model, the Treasury Department and the IRS considered the statutory definition of lifecycle GHG emissions in section 211(o)(1)(H) of the Clean Air Act (as in effect on August 16, 2022) and the specific objectives of section 45V, and consulted with the DOE. 45VH2–GREET best meets these parameters. It is a model specifically developed by the Argonne National Laboratory as a derivative of and successor to the R&D GREET model, designed specifically to address hydrogen production processes and to meet the requirements and objectives of section 45V.

The R&D GREET model has been maintained by the DOE since 1995 to enable research regarding lifecycle analyses of hundreds of different methods of producing, delivering, and using energy. The model includes many fuels other than hydrogen (for example, biofuels, synthetic fuels, fossil fuels, and electrification), and includes information that is based on preliminary analyses (that is, analyses that are not yet complete, have significant technical uncertainties, or are still being reviewed by laboratory staff, DOE staff, or independent experts).[8] Annual updates to the model inform academic studies, informally guide decarbonization strategies and research and development funded by both the DOE and industry, and elicit stakeholder feedback that can improve the model, particularly with regard to preliminary pathways. R&D GREET is a valuable tool to characterize the benefits and impacts of energy technologies in a directional manner and to test out new and updated data and parameters, but it is not appropriate for use in analyses where a relatively high degree of precision and certainty is required, given the preliminary nature of much of the information represented, and where specific emissions fluxes and their representation are needed in a specific fashion (for example, to meet specifications within the statute). Moreover, because the R&D GREET model offers users many choices regarding analysis methodology (for example, co-product accounting, system boundaries, and global warming potential values), different users can achieve significantly different estimated GHG emissions rates even when representing the same facility. Many of these choices would not be appropriate in the specific context of the section 45V credit given the preliminary nature of much of the data underlying aspects of the R&D GREET model and the fact that the model does not require the use of specific methodologies and accounting parameters. Accordingly, R&D GREET does not provide the degree of certainty, structure, and specificity necessary to meet the statutory requirement of reflecting lifecycle GHG emissions as defined by section 211(o)(1)(H) of the Clean Air Act (as in effect on August 16, 2022), nor does it meet the specific objectives of such section or of the section 45V credit.

[7] Regulatory Impact Analysis, Renewable Fuel Standard Program, U.S. Environmental Protection Agency, EPA–420–R–10–10–006, at 311–312 (Feb. 2010), available at *https://www.regulations.gov/document/EPA-HQ-OAR-2021-0324-0652.*

[8] *See generally GREET,* Office of Energy Efficiency & Renewable Energy, U.S. Department of Energy, available at *https://www.energy.gov/eere/greet.*

In addition, implementation of the section 45V credit will be aided by a user-friendly model that characterizes the lifecycle GHG emissions rates of different hydrogen production processes consistently, with high levels of confidence, and with higher fidelity than R&D GREET, and consistent with the requirements, purposes, and objectives of the section 45V credit. The DOE directed the Argonne National Laboratory to develop 45VH2–GREET to meet three key parameters: (1) consistency of background assumptions for all users and across hydrogen production processes, while enhancing user friendliness, (2) technical robustness of the processes, and (3) consistency with the other requirements and purposes of section 45V. Each of these parameters is explained in additional detail as follows.

First, 45VH2–GREET facilitates consistent analyses across different processes while enhancing user friendliness. While R&D GREET allows users to simulate hundreds of different fuel pathways (including but not limited to those that involve hydrogen) and several different system boundaries with different user-defined assumptions, 45VH2–GREET exclusively allows simulations of the well-to-gate emissions associated with hydrogen production (as specified in section 45V(c)(1)(B) and in alignment with these final regulations). The simpler interface in 45VH2–GREET as compared to R&D GREET ensures that the model is accessible to a broad range of taxpayers, including those without significant prior experience in lifecycle analysis or a GREET model.

Second, 45VH2–GREET achieves technical robustness across hydrogen production pathways. Hydrogen production pathways represented in 45VH2–GREET are a subset of those in R&D GREET and were included following rigorous interagency review for technical fidelity and alignment with the statute. While additional hydrogen production pathways are available in R&D GREET, many are preliminary in nature and inappropriate for analyses requiring relatively high precision, data reliability, and analytical rigor to support use in implementation of the section 45V credit (as described previously in this part of the Summary of Comments and Explanation of Revisions and further in supporting documentation to R&D GREET [9]). Implementation of the section 45V credit necessitates the use of lifecycle GHG emissions rate calculations that are as precise and robust as feasible, as section 45V(b)(2) provides differing applicable percentages based on a range of lifecycle GHG emissions rates and section 45V(c)(2)(A) includes within the definition of qualified clean hydrogen only hydrogen produced with a lifecycle GHG emissions rate below a threshold level. Absent analytically robust emissions calculations, these final regulations would fail to implement Congress's directive to incentivize qualified clean hydrogen production, as distinguished among the different applicable percentage brackets, as well as fail to realize Congress's underlying objective of crediting only qualified clean hydrogen and providing greater credit amounts to hydrogen produced with lower lifecycle GHG emissions rates. As data on and analyses of additional hydrogen production pathways in R&D GREET become more robust, such pathways may be incorporated into future versions of 45VH2–GREET.

Additionally, 45VH2–GREET was developed to align with the text of section 45V, which requires that the credit be based on the ''lifecycle greenhouse gas emissions'' as defined under section 211(o)(1)(H) of the Clean Air Act, subject to the additional requirements of section 45V(c)(1)(B), which references the use of GREET or a successor model as determined by the Secretary, and limits the emissions estimates to ''well-to-gate'' emissions. Lifecycle GHG emissions are defined in section 211(o)(1)(H) of the Clean Air Act to include both direct emissions and significant indirect emissions. R&D GREET does not robustly account for the variability in emissions estimates of all potential significant indirect emissions of certain hydrogen production pathways, particularly when representing counterfactual scenarios. The model additionally does not address the risk of significant indirect emissions related to changes in market behavior associated with the incentives created by section 45V.[10] The proposed regulations therefore asked for comments on lifecycle analysis (LCA) considerations associated with hydrogen production pathways.

In characterizing the lifecycle GHG emissions rate of a given hydrogen production pathway, 45VH2–GREET reflects key drivers of ''lifecycle greenhouse gas emissions'' as defined by section 45V(c)(1)(A) by cross-reference to section 211(o)(1)(H) of the Clean Air Act, subject to the additional requirements of section 45V(c)(1)(B). Consistent with the Clean Air Act, 45VH2–GREET, in conjunction with the broader regulatory framework, addresses direct GHG emissions (for example, at a hydrogen production facility) and significant indirect emissions (for example, upstream emissions associated with electricity consumption at a hydrogen production facility).

Third, 45VH2–GREET is consistent with the other requirements and purposes of section 45V. The accurate and fair administration of the section 45V credit requires the use of fixed ''background data'' assumptions for parameters for which bespoke inputs from hydrogen producers would present challenges for tax administration, which requires high fidelity to ensure the accurate assessment and reporting of lifecycle GHG emissions rates associated with the production of hydrogen. Allowing taxpayers to provide bespoke values for parameters that cannot be accurately determined at an individual taxpayer level or cannot be verified would invite exaggerated or understated estimates that could result in inaccurate section 45V credit determinations. Use of verifiable data ensures that the section 45V credit is available only to those facilities that meet statutory requirements and that the appropriate section 45V credit amount is determined with respect to those facilities. To facilitate the use of bespoke values where feasible and the use of appropriate alternative values where that is not feasible, as well as consistency across taxpayers, the proposed regulations introduced the concepts of ''background data'' (which cannot be changed by 45VH2–GREET users) and ''foreground data'' (which allows for bespoke inputs by 45VH2–GREET users), and 45VH2–GREET distinguishes between them in a consistent manner. For example, 45VH2–GREET incorporates the GHG emissions rates of regional grids as a

[9] *Summary of Expansions and Updates in R&D GREET 2023* (2023), Argonne National Laboratory, available at *https://greet.anl.gov/files/greet-2023-summary* (R&D GREET Supporting Documentation).

[10] For example, in a December 13, 2023, letter to the Treasury Department, the EPA noted that it has interpreted section 211(o)(1)(H) of the Clean Air Act in the context of the Clean Air Act's RFS program. In that context, the EPA had previously determined that the version of ANL GREET that existed in 2010 (that is, R&D GREET) was not sufficient to calculate lifecycle GHG emissions for purposes of 211(o)(1)(H) of the Clean Air Act. The EPA also explained that the more recent version of ANL GREET that existed as of December 2023 similarly did not satisfy the relevant Clean Air Act criteria because it did not include the significant direct and indirect emissions that the EPA had previously determined were necessary. *See* Letter from Joseph Goffman, Principal Deputy Assistant Administrator for the Office of Air and Radiation, U.S. Environmental Protection Agency, to Lily Batchelder, Assistant Secretary for Tax Policy, U.S. Department of the Treasury (Dec. 13, 2023), available at *https://home.treasury.gov/system/files/136/Final-EPA-letter-to-UST-on-SAF-signed.pdf.*

fixed background data parameter that users cannot change. The values incorporated in 45VH2–GREET as background data are based on individual power generators' reporting to the U.S. Energy Information Administration (EIA), emissions factors derived from the EPA's Emissions & Generation Resource Integrated Database (eGRID), estimates of upstream emissions derived by Argonne National Laboratory, and estimates of transmission and distribution losses based on State level reporting to the EIA. Given that GHG emissions estimates of regional grids are derived using the best available data and science, it is unlikely that a given taxpayer would be able to establish a value that differs materially from the 45VH2–GREET default and also has high fidelity. Moreover, given that this parameter is expected to be consistent across all taxpayers within a given region, it is appropriate to require that all such taxpayers utilize the same value rather than allowing for deviation across facilities.

Thus, 45VH2–GREET is consistent with the specific requirements of section 45V while maintaining R&D GREET's overall modeling approach and much of R&D GREET's background assumptions. This furthers the purposes reflected in section 45V(c)(1)(A) and (B). For these reasons, the Secretary has determined that 45VH2–GREET is a successor model for purposes of section 45V(c)(1)(B), and the final regulations require its use. Accordingly, proposed § 1.45V–1(a)(8)(ii) is modified and renumbered as § 1.45V–1(a)(9)(ii) to provide that the term ''45VH2–GREET Model'' means the latest publicly available version of 45VH2–GREET developed by Argonne National Laboratory and published by the DOE, as identified in the instructions to the latest version of Form 7210, or a successor form(s), on the first day of the taxable year during which the qualified clean hydrogen for which the taxpayer is claiming the section 45V credit was produced. Additionally, as further discussed in this Summary of Comments and Explanation of Revisions, proposed § 1.45V–4(a) is modified to provide that the lifecycle GHG emissions rate of each hydrogen production process at a qualified clean hydrogen production facility is determined under the 45VH2–GREET Model. Conforming changes have also been made throughout the regulatory text to replace ''most recent GREET model'' with ''45VH2–GREET Model.''

b. Differences From R&D GREET

Several comments requested that 45VH2–GREET include all the pathways and technologies that are present in R&D GREET. Some of these comments also requested that 45VH2–GREET employ the same methodology used for measuring lifecycle GHG emissions as those used in R&D GREET. Some comments specifically requested that the transportation-related emissions be consistent between the two models.

The final regulations do not adopt these comments. As described in the 45VH2–GREET User Manual and as described in this part I.A.6 of the Summary of Comments and Explanation of Revisions, some pathways may be included in R&D GREET but not in a given version of 45VH2–GREET because the pathways were still preliminary when such version of 45VH2–GREET was developed and/or because the pathways did not adequately address all key sources of direct and significant indirect emissions (as required for consistency with section 211(o)(1)(H) of the Clean Air Act). Uncertainties around many of these pathways may include parameters such as identification of all relevant feedstocks or the choice of counterfactual scenarios. These uncertainties are described in sections 2.1.1 and 2.1.4 of the R&D GREET Supporting Documentation. Some pathways, such as those using certain types of biomass, also had uncertainties and had not completed the 45VH2–GREET technical review process at the time the most recent version was released, but may be added in future updates as data and other parameters become more robust. The proposed regulations requested comments on lifecycle analysis considerations associated with some of the pathways that were not included in the initial 45VH2–GREET release (for example, certain RNG pathways and fugitive methane), which could inform future updates to the model.

Some specific aspects of hydrogen production pathways within R&D GREET have completed an interagency review process, have been deemed sufficiently robust and, have therefore also been included in 45VH2–GREET. Examples include default assumptions associated with methane leakage during natural gas transportation to a facility or assumptions of the emissions that result from electricity generation from specific generators. Thus, some assumptions related to transportation emissions have been made consistent between R&D GREET and 45VH2–GREET, while other assumptions are still too uncertain to include in 45VH2–GREET but may be included if deemed sufficiently robust in the future based on evaluation by interagency technical experts.

R&D GREET is used for a range of purposes, including academic studies and research that do not necessarily require verification of assumptions with real-world data at specific facilities and at times rely on small and therefore uncertain sample sizes or datasets. Implementation of the section 45V credit, however, requires that information used to calculate the lifecycle GHG emissions rate reflect a given taxpayer's actual operation with a reasonable degree of certainty and be subject to independent verification where possible or, where not, that values used appropriately reflect the range of possibilities rather than allowing use of unverifiable inputs that inappropriately maximize the amount of the section 45V credit. As described previously, use of verifiable data is necessary in the context of tax administration and in particular with respect to the section 45V credit where eligibility for the amount of the credit is based on the facility's lifecycle GHG emissions rate.

c. Emissions Through the Point of Production (Well-to-Gate)

Proposed § 1.45V–1(a)(8)(iii) would have provided that, for purposes of section 45V(c)(1)(B) and proposed § 1.45V–1(a)(8)(i), the term ''emissions through the point of production (well-to-gate)'' means the aggregate lifecycle GHG emissions related to hydrogen produced at a hydrogen production facility during the taxable year through the point of production. Further, proposed § 1.45V–1(a)(8)(iii) would have provided that such term includes emissions associated with feedstock growth, gathering, extraction, processing, and delivery to a hydrogen production facility. Finally, proposed § 1.45V–1(a)(8)(iii) would have provided that such term includes the emissions associated with the hydrogen production process, inclusive of the electricity used by the hydrogen production facility and any capture and sequestration of carbon dioxide generated by the hydrogen production facility.

Some comments requested clarification on the definition of ''well-to-gate'' and whether emissions related to hydrogen purification, compression, liquefaction, transport, storage, and other activities are included in the definition for purposes of calculating the lifecycle GHG emissions rate of the hydrogen. Other comments provided feedback on the requirement in proposed § 1.45V–1(a)(8)(iii) that

taxpayers calculate the lifecycle GHG emissions rate of hydrogen produced at a hydrogen production facility based on the aggregate amount of hydrogen produced at the facility over the taxable year (in other words, use the average annual emissions rate). While some comments supported requiring taxpayers to calculate the lifecycle GHG emissions rate of hydrogen on an annual basis, other comments requested that taxpayers be permitted to calculate the lifecycle GHG emissions rate of hydrogen produced at their facility on a more granular basis. One comment expressed disappointment that the Treasury Department and the IRS did not engage States in defining lifecycle GHG emissions. Another comment recommended that the final regulations require State governments to adopt regulations to complement and enhance section 45V. Finally, one comment requested that the term ''emissions through the point of production (well-to-gate)'' exclude emissions from the production of hydrogen during natural disasters, emergency events, start-ups, shut-downs, and maintenance activities.

Regarding the request for clarification of whether specific activities fall within the well-to-gate system boundary, the definition of ''emissions beyond the point of production (well-to-gate)'' in proposed § 1.45V–1(a)(8)(iii) and renumbered as § 1.45V–1(a)(9)(iii) is sufficiently clear. Comments have indicated confusion, however, as to how the well-to-gate system boundary and the definition of facility interact. To clarify, the well-to-gate system boundary for purposes of determining the lifecycle GHG emissions rate of a process is distinct from the definition of facility for Federal income tax purposes. First, as specified in § 1.45V–1(a)(9)(iii), the well-to-gate system boundary includes certain emissions that occur upstream of the facility. For example, the well-to-gate system boundary includes emissions associated with feedstock growth, gathering, extraction, processing, and delivery to a hydrogen production facility. While such emissions are included in the well-to-gate system boundary, equipment used in such upstream activities—such as electricity generating equipment—is not part of the facility, as specified in § 1.45V–1(a)(7)(ii)(B). Second, as further specified in § 1.45V–1(a)(9)(iii), the well-to-gate system boundary also includes all emissions resulting from the facility's hydrogen production process, inclusive of the production of a mixed gas or impurity and the electricity used by the hydrogen production facility and any capture and sequestration of carbon dioxide generated by the hydrogen production facility. This includes emissions resulting from the use of all components that function interdependently to produce the qualified clean hydrogen for which the section 45V credit is determined. Emissions from activities that occur after the facility's hydrogen production process is complete, such as liquefaction, storage, or transport, are generally beyond the well-to-gate system boundary. The final regulations include a non-exhaustive list of examples of such activities in § 1.45V–1(a)(9)(iii). Finally, as explained in part I.A.6.d, § 1.45V–1(a)(9)(iv) is added to provide that emissions that result from certain purification activities that occur downstream of the facility's qualified clean hydrogen production process are still within the well-to-gate system boundary. Even though equipment used in such purification activities is not part of the facility, emissions associated with such purification are nevertheless within the well-to-gate system boundary for purposes of determining the section 45V credit.

However, the Treasury Department and the IRS, based on advice of the DOE, note that, in situations where a man-made chemical is produced using hydrogen feedstock (for example, ammonia), and is later cracked or ''dehydrogenated'' to release the hydrogen, the chemical represents a means of hydrogen storage and the cracking step releases the hydrogen from such storage. These steps occur downstream of hydrogen production and are therefore outside of the well-to-gate system boundary, and also do not constitute a distinct hydrogen production process. Accordingly, hydrogen released from cracking such chemicals cannot be used to claim the section 45V credit.

Regarding the requirement that taxpayers calculate the lifecycle GHG emissions rate of their hydrogen on an annual basis, these comments are addressed in response to comments received on proposed § 1.45V–4(a) in part III.A of this Summary of Comments and Explanation of Revisions.

Regarding a comment's criticism that the Treasury Department and the IRS did not engage the States in defining lifecycle GHG emissions, this term is defined in section 45V(c)(1)(A) as having the same meaning given such term under section 211(o)(1)(H) of the Clean Air Act. Moreover, States were afforded the opportunity to comment on the proposed regulations, and some did. Section 45V does not require State governments to take any action or to enact any legislation to complement section 45V. Section 45V provides a Federal income tax credit to owners of qualified clean hydrogen production facilities for the production of qualified clean hydrogen and imposes no obligations on the States. Accordingly, these final regulations do not adopt the request to require the States to enact legislation to complement section 45V.

Finally, regarding the request to exclude emissions from the production of hydrogen during periods of natural disasters, emergency events, start-ups, shut-downs, and maintenance activities, section 45V(c)(1) does not provide for or contemplate any such exceptions. These final regulations, therefore, do not adopt this comment's suggestion.

d. Certain Emissions Related to Purification Treated as Through Point of Production

In consultation with the DOE, the final regulations add a new § 1.45V–1(a)(9)(iv), which addresses emissions attributable to the purification of hydrogen. Section 1.45V–1(a)(9)(iv) provides that, if the taxpayer knows or has reason to know the purification of a hydrogen gas stream (that is, removal of a mixed gas or impurity) is necessary for a hydrogen gas stream to be productively used, or to be sold for productive use, any lifecycle GHG emissions relating to such purification (for example, emissions from electricity used in purification, or carbon dioxide that is separated from a hydrogen gas stream and then vented as part of purification) are treated as emissions through the point of production (well-to-gate). Additionally, if the taxpayer knows or has reason to know that a hydrogen gas stream contains less than 99 percent hydrogen and will be combusted without purification, any lifecycle GHG emissions relating to the purification needed to purify the hydrogen gas stream to contain 99 percent hydrogen are treated as emissions through the point of production (well-to-gate). Section1.45V–1(a)(9)(v) provides an example to illustrate this rule.

To ascertain the emissions associated with production of hydrogen in a manner that is consistent with section 45V, which requires that section 45V credit eligibility be determined on the basis of ''kilograms of CO2e per kilogram of hydrogen'', 45VH2–GREET levelizes all well-to-gate emissions associated with a hydrogen production process over only the kilograms of pure hydrogen produced. This includes emissions attributable to the purification of a hydrogen gas stream to remove a mixed gas or impurity. Emissions attributable to purification

include emissions associated with energy consumption (for example, electricity consumed by purification equipment or by equipment used for carbon dioxide capture), as well as greenhouse gases that are separated out by purification equipment and not sequestered (for example, carbon dioxide that is captured and then vented).

Previous versions of 45VH2–GREET accounted for carbon dioxide emissions that may occur from the conversion of impurities or mixed gases downstream of the hydrogen production facility, thus including such emissions in the levelization. This approach will be revised in the forthcoming January 2025 version of 45VH2–GREET, such that emissions outside of the well-to-gate boundary are not accounted for in determining a process' lifecycle GHG emissions rate for purposes of section 45V. Qualified clean hydrogen production facilities can therefore be designed to achieve the level of purity required for sale or use (subject to the rules of section 45V and these final regulations), without regard to the carbon dioxide emissions that may occur from the conversion of impurities or mixed gases downstream (for example, the ultimate conversion to carbon dioxide of methanol produced from a mixed gas stream of hydrogen and carbon monoxide).

As the result of the January 2025 modification to 45VH2–GREET and the 45VH2–GREET User Manual, and to clarify the appropriate well-to-gate boundary, these final regulations, following consultation with the DOE, clarify the definition of emissions through the point of production (well-to-gate) to address emissions attributable to purification that the taxpayer knows or has reason to know are necessary in order for the hydrogen gas stream to be productively used, regardless of where such purification occurs. These emissions are properly treated as occurring within the well-to-gate boundary in § 1.45V–1(a)(9)(iv).

In certain cases—absent the section 45V credit—the taxpayer would normally purify a hydrogen gas stream prior to it being productively used or sold for productive use, and such purification would have lifecycle GHG emissions attributed to the hydrogen produced. Taxpayers, however, could have an incentive to claim that the purification (and its attendant emissions) occurs beyond the hydrogen production ''gate.'' If these emissions occur outside of the ''gate,'' then they would not be attributed in 45VH2–GREET to the hydrogen production process and therefore would not be included in the hydrogen production process' lifecycle GHG emissions rate for purposes of determining the amount of the section 45V credit. The taxpayer may, for example, forgo hydrogen purification that it would have performed absent the incentive of the section 45V credit, and produce comparatively ''impure hydrogen.'' The ''impure hydrogen'' may then be sold to a customer who would purify the hydrogen gas stream (something it would not need to do absent the incentive to the hydrogen producer due to the section 45V credit), thereby generating lifecycle GHG emissions that the taxpayer was able to forgo. Similarly, a taxpayer could have an incentive to instead sell a stream of impure hydrogen and a mixed gas or impurity (such as carbon monoxide), instead of the purified hydrogen gas stream, for combustion. The DOE has advised that, absent the section 45V credit, hydrogen gas streams are consistently sold at purity levels well above 99 percent today and that customers would likely have to substantially modify their operations to accept less pure gas streams. Therefore, DOE has advised that the predominant motivation to sell hydrogen for combustion at lower purities would be so the emissions associated with those impurities would not be accounted for within the well-to-gate boundary.

These circumstances would be inconsistent with a purpose of section 45V, which is to provide an incentive to produce qualified clean hydrogen and to provide a higher incentive to produce qualified clean hydrogen as more lifecycle GHG emissions are avoided. Producing hydrogen with a lower lifecycle GHG emissions rate and receiving a section 45V credit reflecting such an emissions rate in the case where the taxpayer knows or has reason to know that the customer must further purify the hydrogen gas stream (and emit additional emissions) so that such gas stream can be productively used by its customer is contrary to this purpose and to the requirement in section 45V(c)(2)(B)(i)(II) for hydrogen to be produced in the ordinary course of a trade or business of the taxpayer. To address this, and consistent with the purposes of section 45V, in cases where the taxpayer knows or has reason to know that additional purification is needed for a hydrogen gas stream to be productively used, the final regulations clarify that the emissions associated with the purification needed to produce the hydrogen for a productive use occur within the well-to-gate boundary. Likewise, in cases where the taxpayer knows or has reason to know that a hydrogen gas stream contains less than 99 percent hydrogen and will be combusted without purification, emissions that would have resulted from purifying the hydrogen gas stream to that percentage prior to combustion are treated as emissions within the well-to-gate boundary.

The final regulations are consistent with the treatment of emissions related to purification in the January 2025 version of 45VH2–GREET, which treats emissions attributable to purification that the taxpayer knows or has reason to know are necessary in order for the hydrogen gas stream to be productively used as within the gate.

7. Process

Section 45V(c)(1)(A) and (B) establish the boundaries for determining lifecycle GHG emissions rates associated with the production of hydrogen. Section 45V(c)(1)(A) mandates consideration of GHG emissions that are described in section 211(o)(1)(H) of the Clean Air Act. Section 45V(c)(1)(B) further specifies that the term ''lifecycle greenhouse gas emissions'' only includes emissions through the point of production (well-to-gate), as determined under the most recent GREET model or a successor model as determined by the Secretary. Accordingly, section 45V(c)(1)(B) specifies an ending boundary (that is, the gate of a hydrogen production facility) for the emissions that must be considered for purposes of the section 45V credit. It also specifies a model for use in determining lifecycle GHG emissions rates. Taken together, these statutory rules provide the boundaries for assessing lifecycle GHG emissions for purposes of section 45V.

Section 45V provides authority for the Secretary to specify and clarify how to determine lifecycle GHG emissions rates within these statutorily determined boundaries. Exercise of this authority is necessary because this statutory framework must address a wide range of hydrogen production processes that are currently viable or that may become viable in the future, the technical details of each hydrogen production process, and scientific advancements and uncertainties associated with lifecycle GHG analyses. Congress acknowledged that the Secretary would need to identify a system for determining lifecycle GHG emissions rates and expressly delegated to her the authority to do so in section 45V(f), which provides ''the Secretary shall issue regulations or other guidance to carry out the purposes of this section, including regulations or other guidance for determining lifecycle greenhouse gas

emissions.'' As noted previously, this authority is cabined by the directives in the statute, most critically the directive to measure well-to-gate lifecycle GHG emissions as defined by section 211(o)(1)(H) of the Clean Air Act.

The term ''process,'' as used in sections 45V(b)(2)(A) through (D) and in section 45V(c)(2)(A), is a parameter that requires further clarification. Proposed § 1.45V–4(a) and (b) would have required the section 45V credit to be determined according to the lifecycle GHG emissions rate of all hydrogen produced at a hydrogen production facility during the taxable year. Under this proposal, the term ''process'' included all the operations and inputs used by a facility to produce hydrogen during a taxable year.

The Treasury Department and the IRS received a number of comments which led to a reconsideration of how the term ''process'' is used in determining lifecycle GHG emission rates. After reviewing these comments and reexamining the meaning of the term ''process'' as it relates to the structure and purposes of section 45V, these final regulations add § 1.45V–1(a)(11) to define the terms ''process'' and ''primary feedstock,'' as discussed further in this part I.A.7 of this Summary of Comments and Explanation of Revisions. These final regulations also make a corresponding modification to § 1.45V–1(b) regarding the amount of the credit.

Several comments recommended that 45VH2–GREET allow for the blending of feedstocks, like natural gas and RNG. In the case of RNG, comments claimed that given the high cost of RNG, combining RNG with conventional natural gas could create certain market efficiencies that would justify the combined use of RNG and natural gas. Several comments opposed allowing the mixing of RNG (or other types of biomethane) with conventional natural gas to produce clean hydrogen; in particular, one comment noted that ''splash blending,'' or combining small amounts of RNG with conventional natural gas, could cost the U.S. government billions of dollars annually while potentially increasing overall emissions. According to one comment, to avoid splash blending, each methane-based feedstock should be considered a separate production line.

Section 45V generally requires that lifecycle GHG emissions rates be determined according to the process by which the hydrogen is produced. Section 45V(b)(2) provides the rules for determining the applicable percentages that are ultimately used to calculate the amount of the section 45V credit. In general, section 45V(b) requires applicable percentages to be determined with respect to ''qualified clean hydrogen which is produced through a process that results in a lifecycle greenhouse gas emissions rate'' that falls within statutorily mandated emissions rate ranges. Section 45V(c)(2)(A) defines the term qualified clean hydrogen as hydrogen that is produced through a process that results in a lifecycle greenhouse gas emissions rate of not greater than 4 kilograms of CO2e per kilogram of hydrogen.

Section 45V does not expressly define the term ''process.'' The plain meaning of the term ''process'' is ''a series of actions or operations conducing to an end.'' [11] In particular, for lifecycle assessment purposes, the term ''process'' has been defined as a ''set of interrelated or interacting activities that transforms inputs into outputs.'' [12] Building upon these definitions, combined with the statutory distinctions between processes that result in different specified ranges of lifecycle GHG emissions rates, the statutory text indicates that the term ''process'' necessarily includes a degree of uniformity and consistency among those inputs that can meaningfully differ in their GHG intensity. Section 45V(b)(2) provides varying credit amounts for hydrogen that is ''produced through a process that results in a lifecycle greenhouse gas emissions rate'' that falls into specified ranges. The term ''process'' must therefore mean more than just the production technique because the same production technique, such as steam methane reforming, could produce lifecycle GHG emissions rates that fall into different ranges specified in the statute depending on the inputs used. The statute differentiates between ''a process that results in'' one specified range of GHG emissions rates from ''a process that results in'' a different specified range of GHG emissions rates. See section 45V(b)(2)(A) through (D). The only effective way to distinguish between hydrogen production processes is to define the term ''process'' with respect to both the production technique and a class of uniform or similar inputs used in that technique.

This interpretation of the term ''process'' is consistent with the chemical transformations that are used to produce hydrogen, and with the language in section 45V. Treating input feedstocks with significantly different attributes as part of the same hydrogen production process (for example, by averaging the attributes of multiple types of methane used over a time period) often would not accurately reflect the chemical dynamic whereby each molecule of hydrogen originates from distinct source-molecule inputs that have distinct attributes affecting the lifecycle emissions of each hydrogen molecule and, as a result, often would not reflect the lifecycle GHG emissions rate of the resulting hydrogen molecules, as required by the statute. The most granular approach to assessing lifecycle GHG emissions would therefore be to match each molecule of hydrogen with its molecular inputs and identify the lifecycle emissions associated with the resulting hydrogen. However, this level of granularity is impractical to administer and unnecessary to implement the statute. The feasible and appropriate approach to aggregating molecules is to assess each hydrogen production process by grouping source molecules into categories of primary feedstock.

This aggregation approach best implements the statutory requirements of section 45V because the production of hydrogen using inputs with similar attributes can be expected to produce consistent emissions results, allowing the appropriate determination of eligibility and credit amounts under section 45V. An approach that incorrectly assumed all hydrogen molecules are a blend of feedstocks would not yield a correct lifecycle assessment, would have perverse incentive effects (as discussed subsequently in this Summary of Comments and Explanation of Revisions), and would be no more administrable than the approach adopted in these final rules.

With the exception of geologic hydrogen, all hydrogen production processes involve conversion of hydrogen-containing molecules into pure hydrogen. In electrolysis, for example, the feedstock—the source of the hydrogen molecules—is water, which contains no carbon and therefore does not directly produce carbon dioxide (or other GHGs) in the production of hydrogen. By contrast, in steam methane reforming, the feedstock is water and methane, which produces hydrogen and carbon dioxide when reformed. In pyrolysis, the feedstock is organic matter, which produces hydrogen and solid carbon when pyrolyzed. In methane pyrolysis, the feedstock is methane, which is converted into hydrogen and solid

[11] *Process,* Merriam-Webster Dictionary, available at *https://www.merriam-webster.com/dictionary/process.*

[12] International Organization for Standardization, *ISO 14040:2006, Environmental Management—Life Cycle Assessment—Principles and Framework* (2d ed. 2006).

carbon through the application of high temperatures.

Energy attributes and lifecycle GHG emissions can vary considerably among hydrogen-containing feedstocks. For instance, the water inputs into electrolysis generally have limited upstream emissions and zero direct GHG emissions from the chemical reaction that produces hydrogen. Hydrocarbon inputs into methane reforming produce a standard quantity of direct emissions through the chemical reaction that produces hydrogen, but upstream emissions vary considerably for different sources. Different hydrocarbon inputs have significantly different upstream practices (for example, methods of gathering, processing, or delivery) and counterfactuals, among other factors, which result in dramatic differences in resulting lifecycle GHG emissions rates of producing hydrogen from that methane source.

Because of the potential for significant variation in the lifecycle GHG emissions rates associated with different inputs, and the structure of section 45V, it is necessary to assess hydrogen production using different hydrogen-containing feedstocks as distinct processes. Accordingly, these final regulations distinguish processes based on their hydrogen-containing feedstock, which is referred to in these final regulations as a ''primary feedstock.'' A ''primary feedstock'' is defined in § 1.45V–1(a)(11) as a hydrogen-containing chemical that is transformed to produce hydrogen at a hydrogen production facility and has uniform or similar attributes distinguished by the source from which it is derived, if such source materially affects the lifecycle GHG emissions rate associated with use of the chemical to produce hydrogen.

If the term ''process'' were instead interpreted to encompass feedstocks with significantly different attributes as relevant to determining lifecycle GHG emissions, then the approach to determining whether a ''process'' has comported with statutorily prescribed lifecycle GHG emissions rate ranges for the purposes of determining the amount of the section 45V credit would not effectively, in fact, incentivize the production of hydrogen within a specific lifecycle GHG emissions rate range. For example, allowing a process to calculate a single emissions rate based on a mix of feedstocks with disparate attributes would increase the risk that hydrogen production that would otherwise not meet the statutory emissions requirements receives the section 45V credit simply by virtue of being commingled or averaged with hydrogen production that does meet the statutory emissions requirements using other inputs. This would be a foreseeable and inappropriate result if, as several comments urged, the term ''process'' were interpreted as any activities and inputs that resulted in the production of a kilogram of hydrogen. The statute's singular reference to ''a process'' and ''a lifecycle greenhouse gas emissions rate'' indicates that the statutory references to the term ''process'' requires evaluation on the basis of each specific process, with uniformity and consistency across its operations and primary feedstock that generally results in a consistent lifecycle GHG emissions rate. Defining the term ''process'' based solely on the type of a facility's operations that produce hydrogen (for example, steam methane reforming or autothermal reforming) is not appropriate because such operations could rely on feedstocks with materially different attributes and carbon intensities, which would result in very different lifecycle GHG emission rates that would not be observable if feedstocks are aggregated. Thus, feedstocks to a process should have attributes with a sufficient degree of uniformity and consistency to be considered part of the same ''process.'' Separately evaluating each hydrogen production process at a qualified clean hydrogen production facility is consistent with the statutory language and scheme of section 45V, which requires accuracy in determining ''a lifecycle [GHG] emissions rate'' for hydrogen produced via ''a process.'' See section 45V(c)(2)(A).

For these reasons, consistent with the transformation of feedstock in the production of hydrogen, § 1.45V–1(a)(11) defines the term ''process'' to mean the operations conducted by a facility to produce hydrogen (for example, electrolysis or steam methane reforming) during a taxable year using one primary feedstock. A facility producing hydrogen through electrolysis, for example, will have a single hydrogen production process in a taxable year with water as its primary feedstock. Electricity with different attributes would not result in distinct processes because electricity is not a primary feedstock (that is, it is not contributing hydrogen atoms to the hydrogen molecule); additionally, electricity cannot be differentiated at the molecular level. Electricity and heat are integral to the operations of hydrogen production facilities, and the form of energy used by a facility (for example, electricity versus heat) plays an essential role in discerning different hydrogen production processes. The energy powering a facility's operations enables the chemical transformation of molecular feedstocks into hydrogen, but energy does not itself contribute atoms to the hydrogen produced by a facility. Thus, the final regulations do not treat electricity and heat as primary feedstocks, but instead require tracking and assessing the emissions associated with energy used in a process through different mechanisms, as described in part III.D of this Summary of Comments and Explanation of Revisions and specified in 45VH2–GREET. For a facility that produces hydrogen through steam methane reforming using fossil natural gas, for example, the combination of fossil natural gas and water would be considered one primary feedstock because hydrogen molecules derive from both fossil natural gas and water and this form of hydrogen production requires use of both water and methane. Thus, a facility producing hydrogen exclusively through reforming of fossil natural gas with water would have a single hydrogen production process in a taxable year. A facility producing hydrogen through reforming of both fossil natural gas and RNG from animal manure with water would have two hydrogen production processes in that year; the primary feedstock for one process would be fossil natural gas and water, and the primary feedstock for the other process would be RNG from animal manure and water.

As further specified in the 45VH2–GREET User Manual and reflected in 45VH2–GREET, some types of primary feedstocks are distinguished by their origin (for example, methane from a specific source), as well as attributes of that source as relevant to determining lifecycle GHG emissions. While these final regulations cannot anticipate and address all possible primary feedstocks that may be utilized for hydrogen production, the Treasury Department and the IRS note that it is currently appropriate to treat fossil natural gas, RNG derived from landfill gas, RNG derived from animal waste, RNG derived from wastewater treatment plants, and gas derived from coal mine methane as distinct primary feedstocks. If a facility uses any of these gas streams in combination with water via interdependent steps (for example, in the case of reforming), then the combination of that gas stream (for example, fossil natural gas, RNG derived from landfill gas, etc.) and water is a singular primary feedstock. Such treatment implements the definition of primary feedstock adopted here, which treats as a single feedstock that which

has uniform or similar attributes distinguished by the source from which it is derived, if such source materially affects the lifecycle GHG emissions associated with use of the molecule to produce hydrogen.

If a facility utilizes more than one primary feedstock to produce hydrogen, then that facility will have an equal number of separate hydrogen production processes that each must be assessed separately to determine a lifecycle GHG emissions rate for the quantity of hydrogen produced through that process for purposes of section 45V. For example, if a taxpayer procures RNG sourced from a blend of sources, the taxpayer must account for the share of RNG derived from each source distinctly within 45VH2–GREET or an Emissions Value Request Application. Future releases of 45VH2–GREET and analyses conducted through the DOE's EVRP may address additional primary feedstocks, but any new primary feedstock must also be treated as distinct.

The Treasury Department and the IRS note that there is precedent for this type of approach for assessing emissions associated with the production of fuels. The RFS is another example of a framework that requires a determination of what activities should be aggregated or separated for purposes of lifecycle analysis to determine GHG emissions. Similar to the approach provided for here, the RFS conducts LCAs for distinct feedstock-technology-output combinations because those combinations have the potential to have distinct lifecycle emissions that should be credited differently under the RFS's statutory scheme. *See* ''Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program,'' 75 FR 14670, 14713 (Mar. 26, 2010) (EPA final regulation providing that different combinations of feedstock, production process, and fuel that result in different lifecycle GHG outcomes must be evaluated separately).

8. Qualified Clean Hydrogen

Section 45V(c)(2)(A) provides that ''qualified clean hydrogen'' means hydrogen which is produced through a process that results in a lifecycle GHG emissions rate of not greater than 4 kilograms of CO2e per kilogram of hydrogen. Further, section 45V(c)(2)(B) provides that such term does not include any hydrogen unless the production and sale or use of such hydrogen is verified by an unrelated party, and such hydrogen is produced in the United States (as defined in section 638(1) of the Code) or a United States possession (as defined in section 638(2)); in the ordinary course of a trade or business of the taxpayer; and for sale or use. Proposed § 1.45V–1(a)(9) substantially repeats the statutory definition.

Several comments requested clarification on the definition of ''qualified clean hydrogen.'' Some comments requested clarification that hydrogen does not need to be of a certain level of purity to constitute ''qualified clean hydrogen.'' Specifically, comments requested clarification that ''qualified clean hydrogen'' includes hydrogen that is produced as one of several constituents in a gas stream so long as the gas stream is valorized. The comments suggested that the statute does not specify that the hydrogen production must isolate the hydrogen or that the gas stream containing the hydrogen achieve a certain threshold hydrogen content to be eligible for the credit. These comments further suggested that requiring hydrogen to be separated from other components in a gas stream when those components would be immediately recombined with the hydrogen would be inefficient. One comment requested clarification on whether there are specific metering requirements for monitoring the purity of the hydrogen.

These final regulations do not modify the definition of ''qualified clean hydrogen'' to specify a certain level of purity, or to specify that no level of purity is required. A purity requirement does not need to be added to the definition of ''qualified clean hydrogen'' because 45VH2–GREET already accounts for impurities by assessing the well-to-gate emissions of a hydrogen production facility over only the kilograms of pure hydrogen produced. The treatment of mixed gases or impurities is further discussed in part I.A.6.d. of this Summary of Comments and Explanation of Revisions.

The decisions to characterize well-to-gate emissions of hydrogen based only on the kilograms of pure hydrogen produced, and to address impurities through the well-to-gate lifecycle GHG emissions analysis (in 45VH2–GREET or the PER process)—rather than by requiring hydrogen to be of a certain level of purity—are consistent with Congress's directive under section 45V(c)(1)(A) and (B) to determine lifecycle GHG emissions as defined under section 211(o)(1)(H) of the Clean Air Act and 45VH2–GREET.

As to the request for clarification on whether there are specific metering requirements for monitoring the purity of the hydrogen, as discussed in this part, impurities are accounted for through the well-to-gate lifecycle GHG emissions analysis (in 45VH2–GREET or the PER process). Metering requirements for all relevant inputs into 45VH2–GREET, including purity, are addressed in § 1.45V–5(g)(5), and no special metering requirements for purity, apart from those specified in § 1.45V–5(g)(5), are needed.

9. For Sale or Use

For purposes of section 45V(c)(2)(B)(i)(III) and proposed § 1.45V–1(a)(9)(i)(C), proposed § 1.45V–1(a)(9)(ii) would have provided that, the term ''for sale or use'' means for the primary purpose of making hydrogen ready and available for sale or use. Following production, storage of hydrogen before its sale or use would not disqualify such hydrogen from being considered produced for sale or use. No comments were received on proposed § 1.45V–1(a)(9)(ii), and this provision is adopted without change as renumbered § 1.45V–1(a)(13)(ii).

B. Amount of Credit

1. In General

Under section 45V(a), the clean hydrogen production credit is based on the amount of qualified clean hydrogen produced ''during the 10-year period beginning on the date such facility was originally placed in service'' multiplied by the applicable amount identified in section 45V(b). Proposed § 1.45V–1(b)(1) would have incorporated this calculation of the amount of credit by providing that the amount of the section 45V credit determined under section 45V(a) and the section 45V regulations for any taxable year is the product of the kilograms of qualified clean hydrogen produced by the taxpayer during such taxable year at a qualified clean hydrogen production facility during the 10-year period beginning on the date such facility was originally placed in service, multiplied by the applicable amount with respect to such hydrogen.

Several comments requested changes related to the 10-year credit period and the placed in service date specified in proposed § 1.45V–1(b)(1). One comment requested that the 10-year credit period be tolled for circumstances beyond the taxpayer's control or during periods of diminished capacity. Another comment requested that the placed in service date of a qualified clean hydrogen production facility be delayed until operational testing is complete and commercial quantities of hydrogen are produced. Another comment requested that the final regulations provide that a qualified clean hydrogen production facility cannot be placed in service until after December 31, 2022. This comment

suggested that, prior to January 1, 2023, it was impossible to produce qualified clean hydrogen because section 45V, which established what is qualified clean hydrogen, did not become effective until that date. Thus, this comment suggested, no hydrogen production facility could properly be treated as having been placed in service as a ''qualified clean hydrogen production facility'' until that date.

Another comment requested clarification of the requirements for pre-existing facilities that were originally placed in service prior to the enactment of section 45V and the extent to which such facilities can claim the section 45V credit for the years remaining in the 10-year period beginning on the date such facilities were originally placed in service.

These final regulations do not adopt the changes to proposed § 1.45V–1(b)(1) recommended by these comments. Section 45V(a) establishes that the credit is based, in part, on the placed in service date and the definition of ''placed in service'' is sufficiently clear as an established tax concept. Section 1.46–3(d)(1) provides that, for purposes of the section 38 credit (which includes the clean hydrogen production credit determined under section 45V, *see* section 38(b)(36)), property is considered placed in service in the earlier of the taxable year in which, under the taxpayer's depreciation practice, the period for depreciation with respect to such property begins; or the taxable year in which the property is placed in a condition or state of readiness and availability for a specifically assigned function, whether in a trade or business, in the production of income, in a tax-exempt activity, or in a personal activity. Examples of property that is considered in a condition or state of readiness and availability for a specifically assigned function are set forth in § 1.46–3(d)(2). Section 1.46–3(d)(2)(ii) provides that operational farm equipment that is acquired during the taxable year and is not practicable to use until the following year is still considered ready and available for its assigned function in the taxable year. Section 1.46–3(d)(2)(iii) provides that equipment that is operational but is still undergoing testing to eliminate any defects is still considered ready and available for its assigned function. These examples clarify that property can be ready and available for its assigned function regardless of the level of production attained.

Various revenue rulings and case law have established a five-factor test for determining when a facility is placed in service, including (1) whether the necessary permits for operation have been obtained; (2) whether critical preoperational testing has been completed; (3) whether the taxpayer has control of the facility; (4) whether the unit has been synchronized with the transmission grid; and (5) whether daily or regular operation has begun. *See Ampersand Chowchilla Biomass, LLC* v. *United States,* 150 Fed. Cl. 620 (2020) (citing Rev. Rul. 84–85, 1984–1 C.B. 10; Rev. Rul. 79–98, 1979–1 C.B. 103; Rev. Rul. 76–256, 1976–2 C.B. 46; and Rev. Rul. 76–428, 1976–2 C.B. 47), *aff'd,* 26 F.4th 1306 (Fed. Cir. 2022). No one factor is dispositive.

Determining the date on which a qualified clean hydrogen production facility was placed in service is inherently fact intensive, and the existing case law and revenue rulings are sufficient for taxpayers to determine their facility's placed in service date. Relying upon existing standards provides sufficient clarity to taxpayers and avoids the confusion of creating multiple placed in service standards.

Regarding whether the final regulations should provide that the 10-year credit period is tolled to account for circumstances beyond the taxpayer's control or during periods of a facility's diminished capacity, the 10-year credit period is a statutory requirement under section 45V(a)(1), and there is no provision that provides an exception to this statutory rule.

Regarding whether the final regulations should clarify that a qualified clean hydrogen production facility cannot be placed in service until after December 31, 2022, the Treasury Department and the IRS clarify in this Summary of Comments and Explanation of Revisions that a qualified clean hydrogen production facility may have been placed in service prior to January 1, 2023. First, section 45V does not specify an earliest date on which a qualified clean hydrogen production facility must be placed in service to be eligible for the section 45V credit, and as explained in the Explanation of Provisions to the proposed regulations, the owner of a qualified clean hydrogen production facility originally placed in service after December 31, 2012, can claim the section 45V credit for qualified clean hydrogen produced during at least some portion of the 10-year period described in section 45V(a)(1), provided all other requirements are met. Second, providing a rule that a qualified clean hydrogen production facility cannot be placed in service until January 1, 2023, would conflict with section 45V(d)(4), which provides that a facility that did not produce qualified clean hydrogen and that was originally placed in service prior to January 1, 2023, can receive a new, deemed placed in service date as of the date the facility is modified after December 31, 2022, to produce qualified clean hydrogen. If, as the comment suggests, no qualified clean hydrogen production facility could be placed in service until January 1, 2023, then existing hydrogen production facilities would receive a new placed in service date regardless of whether they meet the requirements of section 45V(d)(4), rendering section 45V(d)(4) superfluous. Third, under the comment's reading, no qualified clean hydrogen production facility could be placed in service until the hydrogen production and its sale or use is verified, as those are requirements to have qualified clean hydrogen. Verification might not occur until a taxable year following the year in which the hydrogen was produced, which would prevent the credit from being determined in the first taxable year of production. Fifth, the comment's reading conflicts with section 6417(b)(5), which makes clear that a qualified clean hydrogen production facility can be originally placed in service prior to January 1, 2023. *See* section 6417(b)(5) (an applicable credit includes ''[s]o much of the credit for production of clean hydrogen determined under section 45V(a) as is attributable to qualified clean hydrogen production facilities which are originally placed in service after December 31, 2012.'').

Finally, regarding the requirements and extent to which pre-existing facilities that were originally placed in service prior to the enactment of section 45V can claim the section 45V credit, for the reasons explained herein, this Summary of Comments and Explanation of Revisions clarifies that the owner of a qualified clean hydrogen production facility originally placed in service prior to the enactment of section 45V but after December 31, 2012, can claim the section 45V credit for the qualified clean hydrogen produced during at least some portion of the 10-year period described in section 45V(a)(1), provided all other requirements are met. Thus, owners of pre-existing facilities can potentially claim the section 45V credit for the remaining portion of the 10-year credit period. Alternatively, a pre-existing facility can receive a new date on which it is considered originally placed in service if it satisfies the requirements of § 1.45V–6(a) (regarding the modification of an existing facility to produce qualified clean hydrogen) or

(b) (regarding the retrofitting of an existing hydrogen production facility).

2. Producer of Qualified Clean Hydrogen

For purposes of section 45V(a)(1) and proposed § 1.45V–1(b)(1), proposed § 1.45V–1(b)(2) would have provided that the term ''taxpayer'' means the taxpayer that owns the qualified clean hydrogen production facility at the time of the facility's production of qualified clean hydrogen with respect to which the section 45V credit is claimed, regardless of whether such taxpayer is treated as a producer under section 263A of the Code or under any other provision of law with respect to such hydrogen.

One comment asked whether the phrase ''treated as a producer under section 263A'' in proposed § 1.45V–1(b)(2) has the same meaning as ''produced by the taxpayer'' under section 45X(a)(1)(A). To clarify, the term ''produced by the taxpayer'' as used in section 45X(a)(1)(A) is defined in § 1.45X–1(c) and that definition does not apply for purposes of section 45V. Section 45X and § 1.45X–1(c) address the production of eligible components as that term is used in section 45X, and not the production of hydrogen for purposes of section 45V. Therefore, taxpayers must determine whether they are considered the producer of the qualified clean hydrogen for purposes of determining the credit under section 45V using the definition provided in § 1.45V–1(b)(2), and not by reference to the definition of ''produced by the taxpayer'' under § 1.45X–1(c).

Under section 45V(a)(1) and (c)(3)(A), the taxpayer must be both the owner of the qualified clean hydrogen production facility and the producer of qualified clean hydrogen at the facility to be eligible for the section 45V credit, respectively. The intent of proposed § 1.45V–1(b)(2) was to clarify that, for purposes of section 45V(a)(1) and § 1.45V–1(b)(1), the ''taxpayer'' for these purposes is the owner of the qualified clean hydrogen production facility at the time the hydrogen is produced, regardless of whether the owner is required to capitalize costs under section 263A and § 1.263A–2(a), which provide rules relating to property produced by the taxpayer. As explained in the Explanation of Provisions to the proposed regulations, the definition of ''taxpayer'' in § 1.45V–1(b)(2) is intended, among other things, to avoid unintended consequences that could arise under § 1.263A–2(a)(1)(ii)(A) and (B)(*1*) with respect to contract manufacturing and tolling arrangements in the context of the section 45V credit. For example, under § 1.45V–1(b)(1), an owner of a hydrogen production facility that enters into an arrangement with a third party service recipient to produce qualified clean hydrogen using the service recipient's raw materials and inputs in exchange for a fee (a toller) is considered the producer of the qualified clean hydrogen for purposes of section 45V regardless of whether the toller is required to capitalize costs of producing the qualified clean hydrogen under section 263A. The final regulations provide the intended clarification described previously in this paragraph to § 1.45V–1(b)(2).

3. Increased Credit Amount for Qualified Clean Hydrogen

Proposed § 1.45V–1(b)(3) contained a cross-reference to § 1.45V–3, which provides rules under section 45V(e) that permit the amount of the section 45V credit determined under section 45V(a) and § 1.45V–1(b)(1) to be multiplied by five if certain requirements related to prevailing wages and apprenticeships are met.

Several comments were received relating to the prevailing wage and apprenticeship requirements of section 45V(e). Rules addressing the prevailing wage and apprenticeship requirements of section 45V(e) are provided in § 1.45V–3, which is not included in this rulemaking. *See* TD 9998, *Increased Amounts of Credit or Deduction for Satisfying Certain Prevailing Wage and Registered Apprenticeship Requirements* (89 FR 53184). Accordingly, comments addressing the prevailing wage and apprenticeship requirements are beyond the scope of this rulemaking. These final regulations adopt the language in proposed § 1.45V–1(b)(3) without change.

C. Determination of Credit

Proposed § 1.45V–1(c) would have provided that, subject to any applicable Code sections that may limit the section 45V credit amount, the section 45V credit for any taxable year is determined with respect to the qualified clean hydrogen produced by the taxpayer during that taxable year, although the verification of the production and sale or use of such hydrogen may occur in a later taxable year. The taxpayer would not be eligible to claim the section 45V credit with respect to that hydrogen until all relevant verification requirements, and the verification itself, have been completed. Therefore, despite such verification occurring in a later taxable year, the section 45V credit would be properly claimed with respect to the taxable year of hydrogen production and subject to the general period of limitations for filing a claim for credit or refund. Thus, if verification occurred after the extended return filing due date for the taxable year in which the hydrogen was produced, the taxpayer would need to file an amended return or administrative adjustment request (AAR), as applicable, to claim the section 45V credit for such produced hydrogen.

The Treasury Department and the IRS requested comments on proposed § 1.45V–1(c), and whether taxpayers anticipated that they would be able to complete all the requirements for claiming the section 45V credit, including the requirements for verification specified in proposed § 1.45V–5, by the extended return filing deadline for the taxable year of hydrogen production. Comments were also requested on whether alternatives existed.

Several comments suggested alternatives to the requirement in § 1.45V–1(c) that the credit is determined in the taxable year of hydrogen production. Some comments expressed concern that a late verification report, filed after the extended return filing deadline for the taxable year of hydrogen production, would preclude taxpayers from making an elective payment under section 6417 or transfer election under section 6418, as the necessary elections under those statutes cannot be made on an amended return or AAR. *See* sections 6417(d)(3) and 6418(e)(1).

One comment recommended that taxpayers be allowed to claim the section 45V credit initially without a verification report, then once the verification report for the relevant taxable year is eventually submitted, the credit amount is ''trued up,'' with either the government or the taxpayer remitting funds to reflect the verified emissions rate and amount of production. Some comments requested taxpayers be allowed to make or change an election under section 6417 or 6418 on an amended return or AAR if they are claiming a section 45V credit on such amended return or AAR. Another comment proposed only requiring verification when there has been a change in the operation of a taxpayer's hydrogen production facility since the last verification, claiming that this would reduce the risk of late verifications precluding monetization elections. Finally, one comment asked that taxpayers be allowed to claim the section 45V credit and make an elective payment election or transfer election prior to the formal completion of the verification report to avoid missing the

extended return filing deadline due to a late verification report.

These final regulations do not adopt these comments suggesting revisions to the requirements of proposed § 1.45V–1(c). First, based on the comments received on the timing of verification, the Treasury Department and the IRS anticipate that qualified verifiers will be able to verify a taxpayer's production and sale or use of hydrogen by the deadline for filing the taxpayer's Federal income tax return, including extensions, so there should be no issue with making a timely elective payment or transfer election under section 6417 or 6418, respectively. Second, the requirement that the credit is determined in the taxable year of hydrogen production adheres to the requirement in section 45V(a)(1) that the section 45V credit for any taxable year is determined based on the kilograms of qualified clean hydrogen produced by the taxpayer during such taxable year. Providing a rule that the credit is determined in a year other than the taxable year of hydrogen production—such as the year of verification—would potentially create a timing mismatch between the taxable year in which the hydrogen is produced and creditable under section 45V(a)(1) and the taxable year in which the section 45V credit for such production can be claimed. Third, comments suggesting modifications to the rules regarding elective payment elections or transferability elections under sections 6417 and 6418, respectively, are beyond the scope of this rulemaking under section 45V.

Regarding the comments recommending exceptions to the verification requirements or allowing taxpayers to file verification reports after the section 45V credit has been claimed, the requirement that the production and sale or use of the hydrogen be verified is statutorily prescribed in section 45V(c)(2)(B)(ii), so these final regulations adopt the language in proposed § 1.45V–1(c) without change.

II. Special Rules

A. Coordination With Credit for Carbon Oxide Sequestration

Section 45V(d)(2) provides that no section 45V credit is allowed for any qualified clean hydrogen produced at a facility which includes carbon capture equipment for which a section 45Q credit is allowed to any taxpayer for the taxable year or any prior taxable year.

Proposed § 1.45V–2(a) would have followed that statutory provision and additionally provided that if the so-called ''80/20 Rule'' provided in § 1.45Q–2(g)(5) is satisfied with respect to such carbon capture equipment, and no new section 45Q credit has been allowed to any taxpayer for such carbon capture equipment, then the unit of carbon capture equipment (as defined in § 1.45Q–2(c)(3)) for which the 80/20 Rule is satisfied will not be treated as carbon capture equipment for which a section 45Q credit was allowed to any taxpayer for any prior taxable year for purposes of section 45V(d)(2) and proposed § 1.45V–2(a).

Further, proposed § 1.45V–1(a)(7)(i) would have clarified that equipment (which includes carbon capture equipment) that functions interdependently with other components of property to produce qualified clean hydrogen is part of the qualified clean hydrogen production facility, and proposed § 1.45V–1(a)(7)(ii)(B) would have clarified that electricity production equipment used to power the hydrogen production process, including any carbon capture equipment associated with the electricity production process, is not part of the qualified clean hydrogen production facility.

Several comments requested clarification that a separate, independent production line containing carbon capture equipment for which a section 45Q credit is allowed and that is co-located with a hydrogen production facility at a single industrial site does not disqualify the hydrogen production facility from the section 45V credit. For example, one comment requested clarification that an electricity generation facility that is co-located and interconnected with the hydrogen production facility, and for which the section 45Q credit is allowed, will not disqualify the hydrogen production facility from the section 45V credit. Conversely, some comments recommended that the final regulations modify proposed § 1.45V–1(a)(7)(ii)(B) to disallow the section 45V credit for hydrogen produced using electricity that was generated by an electricity generation facility for which the section 45Q credit is allowed.

One comment appeared to seek clarification that ''allowed,'' with respect to section 45V(d)(2), means the taxpayer has claimed the section 45Q credit on their tax return, not merely that they are eligible for claiming the section 45Q credit. The same comment requested confirmation that a taxpayer can claim the section 45V credit and then claim the section 45Q credit in a later taxable year on the same facility.

Finally, one comment requested an exception to section 45V(d)(2) to allow a taxpayer to claim both the section 45Q and section 45V credits on the same facility if the facility combines hydrogen and CO2 for the purpose of creating synthetic molecules.

These final regulations are not modified in response to these comments. The final regulations are sufficiently clear that the section 45V(d)(2) rules coordinating the section 45V credit with the section 45Q credit for carbon oxide sequestration only apply to the qualified clean hydrogen production facility. The definition of ''facility'' in § 1.45V–1(a)(7), as clarified in these final regulations and described in greater detail in part I.A.4 of this Summary of Comments and Explanation of Revisions, means all the components that function interdependently to produce clean hydrogen through a process that results in the lifecycle GHG emissions rate used to determine the credit, but does not include electricity production equipment used to power the hydrogen production process. Further, disallowing the section 45V credit for hydrogen produced using electricity generated at a facility containing carbon capture equipment for which a section 45Q credit has been allowed would require modifying the definition of ''facility'' at § 1.45V–1(a)(7) to include electricity production equipment. It would also present serious horizontal equity concerns for hydrogen producers who co-locate with electricity generators and those who do not. Therefore, electricity production equipment that powers the hydrogen production process and contains carbon capture equipment for which a section 45Q credit is allowed will not disqualify the hydrogen production facility from the section 45V credit. Further, these final regulations do not modify the definition of facility in § 1.45V–1(a)(7) to address specific co-located equipment used for other industrial processes because creating a rule to specifically address such co-located equipment is not necessary nor possible, given that the determination will depend on the facts and circumstances of such equipment.

Regarding the meaning of the term ''allowed,'' such term generally means that the item was claimed on the return and not challenged by the IRS. *See generally Virginian Hotel Corp. of Lynchburg* v. *Helvering,* 319 U.S. 523, 526–27 (1943); *Lenz* v. *Commissioner,* 101 T.C. 260, 264–65 (1993). The meaning of ''allowed'' is sufficiently clear as an established tax concept, as its definition derives from case law and general tax principles, and because the term ''allowed'' appears so frequently in the Code and its accompanying regulations.

Regarding whether a taxpayer can claim a section 45Q credit in a subsequent taxable year, section 45V(d)(2) contains no such prohibition, so the statute is already sufficiently clear and does not need further clarification.

Finally, regarding the comment's request for an exception to section 45V(d)(2) for the creation of synthetic molecules, the prohibition on claiming the section 45V credit on a facility for which a section 45Q credit has already been allowed is statutory, and the statute provides no such exception.

Accordingly, these final regulations adopt § 1.45V–2(a) as proposed.

B. Anti-Abuse Rule

Section 45V(c)(2)(B)(i) provides, among other things, that hydrogen is not qualified clean hydrogen unless it is produced in the ordinary course of a trade or business of the taxpayer, and for sale or use.

Section 45V(f) empowers the Secretary to issue regulations or other guidance to carry out the purposes of section 45V.

Proposed § 1.45V–2(b)(1) would have disallowed the section 45V credit where the primary purpose of the production and sale or use of qualified clean hydrogen was to obtain the section 45V credit in a manner that is wasteful. Proposed § 1.45V–2(b)(1) would have provided as an example the production of qualified clean hydrogen that the taxpayer knows or has reason to know will be vented, flared, or used to produce hydrogen. This proposed rule is referred to as the ''anti-abuse rule.''

Proposed § 1.45V–5(d)(1) would have provided, among other things, that the qualified verifier must attest that a person has sold or made a verifiable use of such hydrogen. Proposed § 1.45V–5(d)(2) would have provided that a person's verifiable use of hydrogen undergoing verification ''does not include—(i) Use of hydrogen to generate electricity that is then directly or indirectly used in the production of more hydrogen; or (ii) venting or flaring of hydrogen.'' This proposed rule is referred to as the ''verifiable use rule.''

Many comments in response to the proposed regulations made suggestions or asked for clarification regarding the prohibition in proposed § 1.45V–2(b)(1) against the sale or use of hydrogen for the primary purpose of obtaining the section 45V credit in a wasteful manner, often asking that the prohibition not apply to a particular scenario or set of circumstances.

Some comments recommended rules or asked for clarification regarding the prohibition in proposed § 1.45V–2(b)(1) against hydrogen production that the taxpayer knows or has reason to know will be vented or flared. These comments noted that venting and flaring are often required for routine safety or maintenance purposes and contended that such use of venting and flaring should not disqualify facilities from credit eligibility. However, in order to align with the purpose of section 45V and safeguard against abuse, one of these comments asked that the Treasury Department and the IRS more clearly state that it is the amount of clean hydrogen sold or used, not produced, that ultimately determines the credit amount.

One comment asked for explicit assurance that hydrogen produced and sold for use in energy storage would not run afoul of the anti-abuse rule when the stored energy is later used to produce hydrogen.

Some comments suggested disallowing the section 45V credit for hydrogen that is produced at the same time electricity is generated from hydrogen-to-power equipment that is physically connected via pipeline.

Some comments expressed concern that the anti-abuse rule would apply to certain non-abusive scenarios where hydrogen production facilities and hydrogen-based electricity generators operate concurrently but are connected to the same electric grid.

Another comment asked for clarification that capturing excess heat from hydrogen production, converting that heat to electricity, and using that electricity to power the production process does not run afoul of the anti-abuse rule.

Some comments asked for clarification that the anti-abuse rule does not apply to instances where produced hydrogen, in some cases from process waste streams, is used to power the production facility, resulting in lower emissions than would otherwise be achieved.

One comment suggested that the anti-abuse rule should not consider the cost of producing qualified clean hydrogen in relation to the amount of the section 45V credit because doing so would disincentivize development of cost-efficient hydrogen production technologies.

The Treasury Department and the IRS agree that clarification of the anti-abuse rule is appropriate. The DOE has advised that venting of hydrogen downstream of a hydrogen production facility is a standard industry practice where necessary for safety or maintenance reasons. The DOE has also advised that, in the future, flaring of hydrogen that would otherwise have been vented could become standard industry practice to mitigate the environmental impacts of venting. Further, the DOE has advised that concurrent operation of hydrogen production and power generation within the same energy storage system and at the same time may be wasteful if no measures are taken to mitigate or reduce the production and consumption of the hydrogen at the same time; for example, if an electrolytic hydrogen production facility as standard practice is producing hydrogen at the same time as the produced hydrogen is being used to produce electricity. However, the Treasury Department and the IRS clarify here that the anti-abuse rule is not meant to apply to the use of hydrogen to store energy for later conversion to electricity and sale to a regional electricity grid, when a buyer from the grid uses such electricity to produce hydrogen.

Accordingly, these final regulations clarify that the section 45V credit is not allowable if the primary purpose of the sale or use (rather than the production and sale or use) of qualified clean hydrogen is to obtain the benefit of the section 45V credit in a manner that is wasteful. Additionally, these final regulations clarify that the taxpayer obtains the section 45V credit in a wasteful manner if the taxpayer sells qualified clean hydrogen that the taxpayer knows or has reason to know will be vented, flared, used to produce heat or power that is then directly used to produce hydrogen, or otherwise used to produce hydrogen, in excess of standard commercial practices. Hydrogen is used to produce power that is then directly used to produce hydrogen if the hydrogen production facility exclusively uses such power to produce hydrogen or is treated as using the power produced by the electricity generating facility using the hydrogen and such use is verified by the acquisition and retirement of qualifying EACs. Hydrogen is not used to produce power that is then directly used to produce hydrogen if the power produced using hydrogen is merely supplied to the same electricity grid from which the hydrogen production facility draws power. Proposed § 1.45V–2(b)(1) is further modified to provide that venting or flaring for safety or maintenance reasons in the ordinary course of business is a non-abusive commercial industry practice. Consistent with the comment asking for clarity that it is the amount of clean hydrogen sold or used, not produced, that ultimately determines the credit amount, § 1.45V–2(b) of the final

regulations adds that, while not abusive, such venting or flaring is also not a verifiable use under § 1.45V–5(d)(2), and therefore any such hydrogen that is vented or flared for safety reasons is not eligible for the section 45V credit. Finally, these final regulations modify the example in § 1.45V–2(b)(2) (where qualified clean hydrogen is sold to obtain the benefit of the section 45V credit in a manner that is wasteful and thus not eligible for the section 45V credit) to reflect that the hydrogen in that example will be vented or flared in excess of standard commercial practices and add an example in § 1.45V–5(d) to illustrate the verifiable use rule in the context of a facility's use of its own hydrogen within its hydrogen production process, flaring of hydrogen for testing and maintenance, and waste heat recovery.

Finally, the Treasury Department and the IRS disagree with the comment's request that the anti-abuse rule be revised to not consider the cost of producing qualified clean hydrogen relative to the amount of the section 45V credit. The cost of hydrogen production relative to the amount of the section 45V credit is just one of many factors considered in the example provided in § 1.45V–2(b)(2). Whether a particular taxpayer's hydrogen production activities violate the anti-abuse rule will depend on all relevant facts and circumstances, and no one factor is controlling. Because the cost of hydrogen production relative to the value of the credit is not the only relevant factor, the Treasury Department and the IRS do not anticipate that including it within the example will deter investment in cost-efficient technologies.

A few comments asked that the anti-abuse rule be significantly pared back or removed altogether. One comment argued that the anti-abuse rule's prohibition of a wasteful primary purpose has no basis in the statute and is too broad to be authorized by the ''ordinary course of a trade or business of the taxpayer'' requirement of section 45V(c)(2)(B)(i)(II). The same comment proposed revising the anti-abuse rule to disallow the section 45V credit only where the taxpayer's sole purpose is to obtain the credit in a wasteful manner.

The same comment asserted that the anti-abuse rule exacerbates uncertainty by requiring that the rules of section 45V and the section 45V regulations be applied in a manner consistent with the purposes of section 45V and the section 45V regulations, while section 45V only authorizes regulations that carry out the purposes of the statute. The comment further argued that the primary purpose examples of wasteful ''production of qualified clean hydrogen that the taxpayer knows or has reason to know will be vented, flared, or used to produce hydrogen'' have no foundation in the statute. The comment asked for clarification whether a producer having a disqualifying purpose at the time of production or sale is sufficient to disallow the credit under proposed § 1.45V–2(b)(1), or if a disqualifying purpose at production *and* sale is required. The comment suggested that the example at proposed § 1.45V–2(b)(2) seems to indicate that a disqualifying purpose at the time of sale is sufficient to disallow the credit, while proposed § 1.45V–2(b)(1) seems to indicate that a producer must have a disqualifying purpose at production *and* sale for the credit to be disallowed.

First, the argument that section 45V provides no basis to support the prohibition of a wasteful primary purpose through an anti-abuse rule is mistaken because (1) the ''for sale or use'' requirement is plainly a purpose requirement, and the anti-abuse rule implements that purpose requirement; in other words, Congress did not intend that a nominal sale or use for purposes of generating credit claims would entitle taxpayers to the credit, but rather intended that only a sale or use possessing some degree of business purpose or economic effect would suffice; (2) likewise, the ''in the ordinary course of a trade or business of the taxpayer'' requirement justifies an anti-abuse rule since any activity with a primary purpose of wastefully obtaining a tax credit is not within the ordinary course of a trade or business; and (3) section 45V(f) authorizes the promulgation of regulations ''to carry out the purposes of this section'' and the obvious purpose of Congress to increase the supply of clean hydrogen in the United States would be undermined if credit claimants were not required to make their hydrogen reasonably available to legitimate hydrogen consumers. Hydrogen that is not so available cannot affect hydrogen supply.

Second, regarding the comment's objection to the proposed anti-abuse rule's requirement that the rules of section 45V and its regulations must be applied consistently with the purposes of the regulations, these final regulations do not modify the language in the proposed regulations. The section 45V regulations implement the section 45V statute. Therefore, taxpayers must apply the regulations consistently with the purposes of both the statute and its implementing regulations.

Third, the request that the proposed anti-abuse rule be modified to only disallow the section 45V credit where the taxpayer's ''sole purpose'' is to obtain the credit in a wasteful manner is problematic. The ''primary purpose'' requirement is the appropriate standard, because a sole purpose requirement could allow hydrogen producers to argue entitlement to claim the credit when nearly all their output is knowingly wasted while asserting there is some legitimate use for the small remainder thereof.

Fourth, the Treasury Department and the IRS agree that a discrepancy exists between the text of the proposed regulations and the example that would have followed regarding whether a wasteful primary purpose at the time of production or sale or use is sufficient to disallow the credit under proposed § 1.45V–2(b)(1), or if a disqualifying purpose at production and sale or use is required. Accordingly, these final regulations adopt proposed § 1.45V–2(b) with modifications to the rule and the example in order to clarify that only a sale or use with the primary purpose of obtaining the benefit of the section 45V credit in a wasteful manner is sufficient to disallow the credit under § 1.45V–2(b)(1). Note, the requirements of § 1.45V–2(b)(1) are independent of the excessive payment rules provided in § 1.6417–6 and the excessive credit transfer rules provided in § 1.6418–5. Taxpayers making the election under section 6417 or 6418 must separately meet the requirements provided in §§ 1.6417–6 and 1.6418–5.

C. Recordkeeping

Section 6001 provides, among other things, that (1) every person liable for tax under the Code shall keep such records as the Secretary may from time to time prescribe; and (2) whenever the Secretary deems it necessary, she may require any person, by regulations, to keep such records as she deems sufficient to show whether or not such person is liable for tax under the Code.

Section 45V(e)(5) provides that the Secretary shall issue such regulations or other guidance as she determines necessary to carry out the purposes of section 45V(e), including regulations or other guidance which provides recordkeeping or information reporting requirements for purposes of administering the requirements of section 45V(e).

Proposed § 1.45V–2(c) would have provided recordkeeping requirements for all taxpayers claiming the section 45V credit, including requirements related to the section 45V(e) increased credit amount. No comments addressed this provision. Proposed § 1.45V–2(c) is therefore adopted as proposed.

III. Procedures for Determining Lifecycle Greenhouse Gas Emissions Rates for Qualified Clean Hydrogen

A. In General

Proposed § 1.45V–4(a) would have provided that the amount of the section 45V credit is determined under section 45V(a) and proposed § 1.45V–1(b) based upon the lifecycle GHG emissions rate of all hydrogen produced at a qualified clean hydrogen production facility (as defined in proposed § 1.45V–1(a)(10)) during the taxable year. This determination would be required to be made following the close of such taxable year and must include all hydrogen production from the year. *See* proposed § 1.45V–4(b). Further, proposed § 1.45V–4(a) would have provided that the lifecycle GHG emissions rate for purposes of section 45V is determined under the most recent GREET model (as defined in proposed § 1.45V–1(a)(8)(ii)). Finally, proposed § 1.45V–4(a) would have provided that in the case of any hydrogen for which a lifecycle GHG emissions rate has not been determined under the most recent GREET model for purposes of section 45V, a taxpayer producing such hydrogen would be permitted to file a petition for a provisional emissions rate (PER) with the Secretary for a determination of the lifecycle GHG emissions rate with respect to such hydrogen.

Some comments supported the proposed requirement that taxpayers calculate the lifecycle GHG emissions rate of hydrogen produced at a hydrogen production facility based on the aggregate amount of hydrogen produced at the facility over the taxable year (that is, annual emissions averaging). These comments claimed that annual emissions averaging is more straightforward and less administratively burdensome than alternative methods. The comments also claimed that annual emissions averaging is less prone to being manipulated because it takes into consideration all hydrogen produced by the taxpayer over the taxable year. The comments appeared to suggest that sub-annual emissions averaging, where taxpayers could potentially select certain sub-annual periods of clean hydrogen production to offset other sub-annual periods of hydrogen production that would not otherwise meet the lifecycle GHG emissions levels required by section 45V, is inconsistent with section 45V. Finally, some comments argued that annual emissions averaging is more aligned with the capabilities of 45VH2–GREET and therefore would help to facilitate compliance.

In contrast, other comments requested that hydrogen producers be permitted to calculate the lifecycle GHG emissions rate of hydrogen produced at their facility on a more granular basis, suggesting changes to the definition of ''emissions through the point of production (well-to-gate)'' in proposed § 1.45V–1(a)(8)(iii). Comments maintained that determining the lifecycle GHG emissions rate for all hydrogen produced at a given hydrogen production facility during a taxable year is burdensome for taxpayers and creates uncertainty and risk. Some comments requested that lifecycle GHG emissions be permitted to be calculated on an hourly basis, including in the case of hydrogen produced using electricity, and in particular once the qualifying EAC requirements require temporal matching on an hourly basis (see part III.D.3.c of this Summary of Comments and Explanation of Revisions). Without calculation of lifecycle GHG emissions on an hourly basis, according to these comments, hours of hydrogen production that do not have corresponding hourly EACs could increase the lifecycle GHG emissions rate of all hydrogen produced for the year—even hydrogen produced using electricity represented by a corresponding hourly EAC—which would be contrary to the hourly matching principle. These comments note the variability of certain renewable or zero-emissions energy sources and the limited ability of hydrogen production facilities to quickly ramp up and down due to technical and economic reasons. Still, other comments requested that lifecycle GHG emissions be permitted to be calculated on a kilogram-by-kilogram basis, or by batching kilograms of hydrogen into distinct groups, to ensure a more precise determination of a facility's lifecycle GHG emissions rate. One comment requested that, for facilities placed in service before 2028, the credit be determined with respect to the specific volumes of hydrogen that meet the temporal matching EAC requirements of proposed § 1.45V–4(d)(3)(ii) rather than according to the average lifecycle GHG emissions rate of all hydrogen produced at a qualified clean hydrogen production facility on an annual basis.

The Treasury Department and the IRS disagree with eliminating the requirement that, in general, the lifecycle GHG emissions of a hydrogen production process be calculated on an annual basis. Section 211(o)(1)(H) of the Clean Air Act defines ''lifecycle GHG emissions'' as the aggregate quantity of GHG emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes), as determined by the EPA. Determining the lifecycle GHG emissions rate of a hydrogen production process, therefore, requires taking the ''aggregate'' quantity of emissions from a hydrogen production process over the course of the taxable year to derive a single emissions rate. This is consistent with the determination of the section 45V credit on an annual basis. Section 45V(a)(1) provides that ''the clean hydrogen production credit for any taxable year is an amount equal to the product of the kilograms of qualified clean hydrogen produced by the taxpayer *during such taxable year*'' (emphasis added). Calculating lifecycle GHG emissions for a hydrogen production process on an annual basis, therefore, aligns with the manner in which the section 45V credit is determined.

The Treasury Department and the IRS clarify that such annual determination is made separately for each hydrogen production process conducted at a hydrogen production facility during the taxable year. As a result, hydrogen producers will be able to claim higher credit amounts for producing qualified clean hydrogen using lower-emitting hydrogen production processes during the year, such as by using feedstocks with lower carbon intensities. For further discussion on process, see part I.A.7 of this Summary of Comments and Explanation of Revisions (explaining that production using each type of primary feedstock is considered a separate production process).

However, once hourly matching is required for qualifying EACs, hydrogen produced through a process that uses electricity may be at risk of not qualifying for the section 45V credit at an expected amount if a small number of hours are not covered by the acquisition and retirement of qualifying EACs, which could occur as a result of unforeseeable circumstances beyond a taxpayer's control.

Further, if a taxpayer believes it is infeasible to secure EACs from renewable or zero-emissions sources for every hour or a significant share of hours in a taxable year, then calculating lifecycle GHG emissions on an annual basis may cause such taxpayer to have no incentive to produce qualified clean hydrogen or qualified clean hydrogen in the lowest lifecycle GHG emissions tier. This is inconsistent with the purposes of section 45V, which includes encouraging the production of qualified clean hydrogen (with a higher credit amount for hydrogen with lower lifecycle GHG emissions rates) and

investments in hydrogen production facilities and processes that produce qualified clean hydrogen.

Section 1.45V–4(a)(2) of these final regulations provides a method to mitigate the risk associated with potential limitations in the supply of qualifying EACs, coupled with a guardrail to limit availability of this election to processes in which the taxpayer is producing qualified clean hydrogen, calculated on an annual basis. Specifically, proposed § 1.45V–4(a) is modified to provide that, solely for purposes of determining the lifecycle GHG emissions associated with a hydrogen production facility's use of electricity generated on or after January 1, 2030, to produce hydrogen, such emissions may be determined on an hourly basis. If a taxpayer utilizes this method, it must determine all emissions from the facility's use of electricity for the taxable year on an hourly basis. On or after January 1, 2030, when hourly matching is required, a facility's lifecycle GHG emissions from electricity for that hour will reflect the attributes of the qualifying EAC acquired and retired for that hour. In the case of electricity use as part of the hydrogen production process for which the taxpayer does not acquire and retire a qualifying EAC that reflects a specific hour in which such electricity was generated on or after January 1, 2030, the electricity emissions for that hour is determined by assuming that the facility is sourcing power with emissions equal to the default electricity emissions intensity within the regional electricity grid. The January 2025 version of the 45VH2–GREET User Manual provides further information on how such hourly accounting may be conducted in 45VH2–GREET. These final regulations add § 1.45V–4(a)(3)(i) and (ii) to provide examples illustrating the calculation of the lifecycle GHG emissions rate of the process used to produce hydrogen at a qualified clean hydrogen production facility, determined on an annual and an hourly basis, respectively.

This method is provided pursuant to the authority in section 45V(f) to ''issue regulations or other guidance to carry out the purposes of [section 45V].'' With respect to a facility's use of electricity in a hydrogen production process (including a facility that produces hydrogen through electrolysis, which is a single hydrogen production process), these final regulations modify the proposed rules to further incentivize the production of clean hydrogen in light of the temporal matching requirement provided in § 1.45V–4(d)(3)(ii). In particular, once the qualifying EAC requirements require temporal matching on an hourly basis, in the case of hydrogen produced using electricity that is represented by a qualifying EAC, a taxpayer who owns a facility that produces hydrogen through a process that results in annual emissions not greater than 4 kilograms of CO2e per kilogram of hydrogen can elect to determine the emissions associated with the electricity used in that process on an hourly basis. This method would enable hydrogen producers to mitigate the risk that limited availability of qualifying EACs could adversely affect eligibility for the section 45V credit for all hydrogen from a single process.

This method is available only if the process for which an election is made achieves an annual lifecycle GHG emissions rate of not greater than 4 kilograms of CO2e per kilogram of hydrogen for all hydrogen produced pursuant to that process during the taxable year. This guardrail advances the purposes of section 45V because it provides added flexibility and risk mitigation only in circumstances where the hydrogen production process produces hydrogen that, over the course of the year, meets the definition of qualified clean hydrogen on an annual basis. In the absence of this condition, allowing the lifecycle GHG emissions associated with electricity used in a hydrogen production process to be determined on an hourly basis could encourage the production of hydrogen through processes that do not meet the emissions requirements of section 45V, contrary to the statute and the purpose of section 45V.

B. Use of 45VH2–GREET

Proposed § 1.45V–4(b) would have provided procedures to calculate the lifecycle GHG emissions rate of hydrogen produced at a hydrogen production facility using the most recent GREET model as defined in proposed § 1.45V–1(a)(8)(ii) (referring to 45VH2–GREET). Proposed § 1.45V–4(b) would have further provided that for each taxable year during the period described in section 45V(a)(1), a taxpayer claiming the section 45V credit determines the lifecycle GHG emissions rate of hydrogen produced at a hydrogen production facility within the interface of 45VH2–GREET.

The 45VH2–GREET User Manual released in conjunction with the proposed regulations provided that 45VH2–GREET is expected to be updated on at least a yearly basis. Moreover, it mentioned that these updates are expected to include representations of additional hydrogen production processes and updates to background data (as supporting analysis is completed by the Argonne National Laboratory). This means that, under proposed § 1.45V–4(b), use of 45VH2–GREET would result in taxpayers using an updated version of 45VH2–GREET each taxable year (insofar as such an update arises).

Multiple comments raised concern about the requirement for taxpayers to use a potentially updated version of 45VH2–GREET each taxable year during the 10-year credit period due to uncertainty about whether changes to 45VH2–GREET may unexpectedly alter annual emissions assessments, which would directly impact the amount of the section 45V credit. Several comments requested that taxpayers be allowed to ''lock in'' the version of 45VH2–GREET that was available on the date the ''final investment decision'' was made. Similarly, several other comments requested that taxpayers be allowed to use the latest version of 45VH2–GREET that was available on the date the hydrogen production facility was placed in service or the date when construction of the facility began (beginning of construction or BOC). Some of these comments further requested that taxpayers be allowed to use subsequent updated versions of 45VH2–GREET at their discretion. Finally, some comments requested that taxpayers be permitted to rely upon a single version of 45VH2–GREET unless and until there is a material change to the facility's hydrogen production process.

In considering these comments, the Treasury Department and the IRS note that the statute envisions use of updated models, referencing use of ''the most recent'' version of GREET or a successor model. However, the Treasury Department and the IRS understand that taxpayers would benefit from having more certainty about a hydrogen production facility's lifecycle GHG emissions rate throughout the credit period for that facility, and therefore have determined that a beginning of construction safe harbor provision would help mitigate taxpayers' reasonable concern. Accordingly, the final regulations modify proposed § 1.45V–4(b) by adding a second paragraph (§ 1.45V–4(b)(2)) giving taxpayers the option to make an election to use the version of 45VH2–GREET that was in effect on the date when construction of their hydrogen production facility began for the remaining taxable years within the 10-year credit period.

In the case of a facility owned by the taxpayer that began construction prior to December 26, 2023, § 1.45V–4(b)(2) provides taxpayers with the option to make an election to use the first

publicly available version of 45VH2–GREET (that is, the version of 45VH2–GREET released in December 2023) for the remaining taxable years within the 10-year credit period. This election is irrevocable, meaning taxpayers may not subsequently opt to use an updated version of 45VH2–GREET once they have opted to lock-in the applicable version of 45VH2–GREET. Section 1.45V–4(b)(2)(i) of the final regulations further provides that, in the case of a facility that is modified to produce qualified clean hydrogen under section 45V(d)(4) and § 1.45V–6(a), or a facility that is retrofitted in a manner that entitles the facility to a new placed in service date under § 1.45V–6(b), the date the facility began construction is the date construction of the modification or retrofit began. Finally, § 1.45V–4(b)(2)(ii) is added to provide that a taxpayer makes the election with respect to a qualified clean hydrogen production facility's hydrogen production process on Form 7210 by no later than the due date (including extensions) for filing the taxpayer's Federal income tax return for a taxable year ending no later than December 31, 2025, or for the taxable year in which such facility is placed in service, whichever taxable year is later. The election is made separately for each hydrogen production process (but on the same Form 7210). For purposes of determining BOC, taxpayers may rely upon the guidance provided in Notice 2022–61,[13] as well as the guidance issued under sections 45,[14] 45Q,[15] and 48.[16] Changes have also been made to proposed § 1.48–15(d) to provide a corresponding BOC safe harbor with respect to a specified clean hydrogen production facility.

It is appropriate to provide this safe harbor based on a facility's beginning of construction date because it better supports the purpose of taxpayer certainty than a placed in service date, and because, unlike a ''final investment decision'' date, the beginning of construction date is an established, defined concept in tax law. For taxpayers that elect to lock-in a version of 45VH2–GREET, these final regulations do not adopt the comments' suggestions that taxpayers also be given the option to use subsequent updated versions of 45VH2–GREET at their discretion. Such an option would enable taxpayers to lock-in a version of 45VH2–GREET while retaining the option to elect a future version of 45VH2–GREET that would reflect lower lifecycle GHG emissions, which would fail to further the purpose of this safe harbor to provide additional taxpayer certainty.

In all other cases, taxpayers must use the latest version of 45VH2–GREET that is publicly available on the first day of the taxable year during which the qualified clean hydrogen for which the taxpayer is claiming the section 45V credit was produced; or, if a version of 45VH2–GREET becomes publicly available after the first day of the taxable year of production (but still within such taxable year), then the taxpayer may, in its discretion, treat such later version of 45VH2–GREET as the 45VH2–GREET Model.

C. Provisional Emissions Rate (PER)

1. In General

Proposed § 1.45V–4(c)(1) would have provided that, for purposes of section 45V(c)(2)(C) and proposed § 1.45V–4(a), the term ''provisional emissions rate'' or ''PER'' means the lifecycle GHG emissions rate of the process by which qualified clean hydrogen is produced by the taxpayer at a qualified clean hydrogen production facility as determined by the Secretary under proposed § 1.45V–4(c). No comments addressed this definition, so it is adopted as proposed with one change made to clarify that the term ''provisional emissions rate'' or ''PER'' means the lifecycle GHG emissions rate of the hydrogen produced through a process at a hydrogen production facility as determined by the Secretary under § 1.45V–4(c).

2. Restriction on Filing a Provisional Emissions Rate Petition

Proposed § 1.45V–4(c)(2)(i) would have provided that a taxpayer may not file a petition with the Secretary for a PER unless a lifecycle GHG emissions rate has not been determined under the most recent GREET model (as defined in proposed § 1.45V–1(a)(8)(ii) as 45VH2–GREET) for hydrogen produced by the taxpayer at a hydrogen production facility. Further, proposed § 1.45V–4(c)(2)(i) would have provided that a lifecycle GHG emissions rate has not been determined under the most recent GREET model with respect to hydrogen produced by the taxpayer at a hydrogen production facility if it uses a hydrogen production pathway that is not included in the most recent GREET model—that is, if either the feedstock used by such facility or the facility's hydrogen production technology is not included in the most recent GREET model. Proposed § 1.45V–4(c)(2)(i) also would have provided that, if a taxpayer's request for an emissions value from the DOE under proposed § 1.45V–4(c)(5) with respect to the hydrogen produced by the taxpayer at a hydrogen production facility is pending at the time such hydrogen production facility's pathway is included in an updated version of 45VH2–GREET, then the taxpayer's request for an emissions value will automatically be denied.

Some comments, despite proposed § 1.45V–4(c)(2)(i), and in disagreement with its restriction on filing a PER petition, sought to clarify that a taxpayer using a hydrogen production pathway included in 45VH2–GREET may nevertheless file a PER petition because they have independently verifiable data that differs from the background data used by 45VH2–GREET. Many of these comments challenged the appropriateness of the background data used by 45VH2–GREET, claiming that they do not reflect the actual values of such parameters and that more accurate measurements of such parameters can be reliably obtained by taxpayers. These comments therefore requested that taxpayers be allowed to file a PER petition after challenging these assumptions through the EVRP, because using actual values would likely result in a lower and more accurate emissions rate.

The parameters in 45VH2–GREET have been deemed background data if independent verification of bespoke values for individual facilities is expected to be infeasible with reasonable fidelity. The Treasury Department and the IRS recognize that the capabilities of verification resources are evolving, and the DOE is continuously monitoring the availability of robust data and verification methods for both background and foreground data parameters in 45VH2–GREET. For example, as described in part III.E of this Summary of Comments and Explanation of Revisions, an upcoming release of 45VH2–GREET will include upstream methane loss rates as foreground data once enhanced GHG reporting to the EPA is available and other program integrity measures are fully implemented. Once a parameter becomes foreground data in 45VH2–GREET, taxpayers may treat that

[13] 2022–52 I.R.B. 560.

[14] *See* Notice 2013–29, 2013–20 I.R.B. 1085, *clarified by* Notice 2013–60, 2013–44 I.R.B. 431, *then clarified and modified by* Notice 2014–46, 2014–36 I.R.B. 520, *then updated by* Notice 2015–25, 2015–13 I.R.B. 814, *then clarified and modified by* Notice 2016–31, 2016–23 I.R.B. 1025, *and then updated, clarified, and modified by* Notice 2017–04, 2017–4 I.R.B. 541; Notice 2018–59, 2018–28 I.R.B. 196, *modified by* Notice 2019–43, 2019–31 I.R.B. 487, *then modified by* Notice 2020–41, 2020–25 I.R.B. 954, *and then clarified and modified by* Notice 2021–5, 2021–3 I.R.B. 479, *and then clarified and modified by* Notice 2021–41, 2021–29 I.R.B. 17.

[15] *See* Notice 2020–12, 2020–11 I.R.B. 495.

[16] *See* Notice 2018–59, *modified by* Notice 2019–43 *and by* Notice 2020–41, *and then clarified and modified by* Notice 2024–41.

parameter as foreground data in their emissions value request application (through an EVRP in support of the PER process). Allowing taxpayers to provide their own values for background data would run counter to the rationale for determining that a given parameter is background data. The Treasury Department and the IRS note that allowing taxpayers to challenge background data through the EVRP likely would significantly increase the number of emissions value request applications, resulting in substantial administrative burden and administrability concerns for the DOE, and potentially far slower reviews for all interested taxpayers. Therefore, these final regulations do not allow taxpayers to avail themselves of the PER petition process if their hydrogen production pathway (which consists of the combination of production technology and input feedstock materials and sources) is included in 45VH2–GREET regardless of any disagreement with the background assumptions.

Several comments also raised concerns about the treatment of novel variations of hydrogen production pathways that currently are represented in 45VH2–GREET, claiming that the model does not provide the correct emissions value for their variation. These comments asked that the final regulations modify proposed § 1.45V–4(c)(2)(i) to state explicitly that taxpayers may use the PER process for novel variations of existing pathways. These final regulations do not adopt these comments. Since the original version of 45VH2–GREET and supporting documentation were published, the DOE has updated the model and the 45VH2–GREET User Manual to include specific definitions of the feedstocks and technologies represented in the model. Taxpayers who have developed a novel variation of a hydrogen production pathway may use the PER process if their pathway does not meet the definitions of the feedstocks and technologies represented in the 45VH2–GREET Model. The text of § 1.45V–4(c)(2)(i) and the definitions in the 45VH2–GREET User Manual provide sufficient information to taxpayers to determine whether their pathway qualifies for the PER process.

Several comments asked to streamline the process for petitioning for a PER for RNG feedstocks derived from non-landfill sources (for example, food waste, animal waste, and biogas derived from renewable diesel or sustainable aviation fuel production), claiming that these sources make up 30 percent of North American RNG production. It is not clear whether these comments, in requesting to streamline the process for petitioning for a PER, are asking the Treasury Department and the IRS to allow these taxpayers to participate in the PER process altogether or whether they are requesting the Treasury Department and the IRS create a separate, streamlined PER petition process for taxpayers who plan to produce hydrogen using non-landfill RNG. To the extent that the comments ask for the former, as stated above, taxpayers may petition the Secretary for a PER if either the feedstock used by their facility or the facility's hydrogen production technology is not included in 45VH2–GREET. Moreover, it is anticipated that some non-landfill RNG hydrogen production processes (such as from livestock manure) will be added to 45VH2–GREET in 2025, in a manner that is consistent with these final regulations. To the extent that the comments ask for a separate, streamlined PER process, these final regulations do not adopt this request as it is not consistent with the statutory purposes of section 45V to offer preferential treatment to any group of feedstocks.

Lastly, one comment asked that the Treasury Department and the IRS decline to issue a PER for taxpayers using geologic hydrogen until more robust climate and environmental data is available. The Treasury Department and the IRS are aware that emissions analysis of newer methods of hydrogen production, such as geologic hydrogen, is subject to technical uncertainty. The DOE intends to address these uncertainties by engaging with applicants during the EVRP and through independent research. The DOE intends to issue emissions values only when an analysis has been completed robustly addressing these uncertainties, and to an extent comparable to other uncertainties within 45VH2–GREET. Applicants to the PER process will additionally be subject to the independent verification requirements of proposed § 1.45V–5, which will help ensure the key sources of greenhouse gases are reflected in the lifecycle analysis of a given facility. Given these safeguards, the Treasury Department and the IRS clarify in this Summary of Comments and Explanation of Revisions to these final regulations that PERs may be used for any hydrogen production pathway (meaning a specific technology and input feedstock materials and sources) not included in the 45VH2–GREET Model, including geologic hydrogen. No further clarification in the regulatory text is needed; therefore, these final regulations adopt proposed § 1.45V–4(c)(2)(i) with conforming changes made to confirm that the Secretary has designated 45VH2–GREET as a successor model.

Proposed § 1.45V–4(c)(2)(ii) would have specified that, notwithstanding proposed § 1.45V–1(a)(8)(ii), for the taxable year in which the hydrogen production pathway the taxpayer uses to produce hydrogen at a qualified clean hydrogen production facility is first included in an updated version of 45VH2–GREET, the updated version of 45VH2–GREET will be considered the most recent GREET model with respect to the hydrogen produced by the taxpayer at the hydrogen production facility. No comments addressed this provision. It is adopted as proposed with changes made to confirm that the Secretary has designated 45VH2–GREET as a successor model and to clarify that, for purposes of the PER process, the lifecycle GHG emissions rate of the hydrogen produced at a hydrogen production facility is made with respect to hydrogen produced through a process.

3. Process for Filing a Provisional Emissions Rate Petition

Proposed § 1.45V–4(c)(3) would have provided that a taxpayer petitions the Secretary for a PER by attaching a PER petition to its Federal income tax return for the first taxable year of hydrogen production ending within the 10-year period described in section 45V(a)(1) for which the taxpayer claims the section 45V credit for hydrogen to which the PER petition relates and for which a lifecycle GHG emissions rate has not been determined, as defined under proposed § 1.45V–4(c)(2)(i). Proposed § 1.45V–4(c)(3) would have provided that a PER petition must contain (i) an emissions value obtained from the DOE setting forth the DOE's analytical assessment of the lifecycle GHG emissions associated with the facility's hydrogen production pathway, and (ii) a copy of the taxpayer's request to the DOE for an emissions value, including any information that the taxpayer provided to the DOE pursuant to the emissions value request process specified in proposed § 1.45V–4(c)(5).

The Treasury Department and the IRS understand that this filing requirement may mean that a taxpayer must attach voluminous documents to its return, which may cause tax administration issues. For effective tax administration, the Treasury Department and the IRS have modified this provision to state that a PER petition must contain (i) the letter received from the DOE stating the emissions value the DOE determined with respect to the facility's hydrogen

production pathway, and (ii) the DOE control number assigned to the emissions value request of the taxpayer. This information will be sufficient for the Treasury Department and the IRS to be able to request additional information from the taxpayer, as necessary.

Proposed § 1.45V–4(c)(3) would have further provided that, if the taxpayer obtained more than one emissions value from the DOE, then the PER petition must contain the emissions value setting forth the lifecycle GHG emissions rate of the hydrogen for which the section 45V credit is claimed on the Form 7210 to which the PER petition is attached. No comments were received on this provision and it is adopted as proposed with amendments to reflect the new requirements for what a PER petition must contain and to clarify that the taxpayer attaches the PER petition to its Federal income tax return *or information return.*

4. Provisional Emissions Rate Determination

Proposed § 1.45V–4(c)(4) would have provided that upon the IRS's acceptance of the taxpayer's Federal income tax return or information return containing a PER petition, the emissions value specified on such PER petition will be deemed accepted. Proposed § 1.45V–4(c)(4) would have provided that a taxpayer would be able to rely upon an emissions value provided by the DOE for purposes of calculating and claiming a section 45V credit, provided that any information, representations, or other data provided to the DOE in support of the request for an emissions value are accurate. Proposed § 1.45V–4(c)(4) also would have provided that the IRS's deemed acceptance of such emissions value is the Secretary's determination of the PER. Proposed § 1.45V–4(c)(4) would have stated, however, that the production and sale or use of such hydrogen must be verified by an unrelated party under section 45V(c)(2)(B)(ii) and in compliance with the procedures provided in proposed § 1.45V–5. Proposed § 1.45V–4(c)(4) would have stated that such verification and any information, representations, or other data provided to the DOE in support of the request for an emissions value are subject to later examination by the IRS. No comments were received on this provision. This provision is adopted as proposed with a clarification to § 1.45V–4(c)(4) to clarify that the emissions value is deemed accepted upon the taxpayer's filing of its Federal income tax return (or information return), and to clarify that the production, including the data the taxpayer submitted in the PER petition and the data provided to the DOE in support of the taxpayer's EVRP application, and sale or use of the hydrogen must be verified under § 1.45V–5.

5. Department of Energy Emissions Value Request Process

Proposed § 1.45V–4(c)(5) would have provided that, in order to obtain an emissions value, an applicant must submit a request for an emissions value following procedures specified by the DOE. The DOE opened the EVRP to the public on September 30, 2024.

Proposed § 1.45V–4(c)(5) also would have provided that emissions values will be evaluated using the same well-to-gate system boundary that is employed in 45VH2–GREET, as proposed in § 1.45V–1(a)(8)(iii). Additionally, proposed § 1.45V–4(c)(5) would have provided that, if applicable, background data parameters in 45VH2–GREET would be treated as background data (with fixed values that an applicant cannot change) in the EVRP. The EVRP would be subject to any guidance issued under section 45V, including any guidance related to the use of EACs.

Proposed § 1.45V–4(c)(5) would have further provided that an applicant may request an emissions value from the DOE only after a front-end engineering and design (FEED) study or similar indication of project maturity, such as project specification and cost estimation sufficient to inform a final investment decision, has been completed for the hydrogen production facility. Additionally, proposed § 1.45V–4(c)(5) would have provided that the DOE may decline to review applications that are not responsive, including those applications that use a hydrogen production technology and feedstock already in 45VH2–GREET or applications that are incomplete. Guidance and procedures for applicants to request and obtain an emissions value from the DOE are published by the DOE on its 45V Emissions Value Request application page, which may be found at *https://www.energy.gov/eere/45v-emissions-value-request.*

In the Explanation of Provisions to the proposed regulations, the Treasury Department and the IRS requested comments on the appropriate indicators of project readiness that should be in place before an applicant requests an emissions value to ensure that requests correspond to hydrogen production facilities with significant commercial interest, and standards against which these indicators could be measured.

The Treasury Department and the IRS received many comments in response to that request for comments. The comments questioned the FEED study requirement, claiming that these studies are costly and create uncertainty in investment decisions. The comments claimed that a key economic factor in justifying the cost of a FEED study is the amount of section 45V credit a project can claim, and estimating the credit without the emissions value is not feasible. The comments further claimed that the level of project maturity required for a FEED study necessitates a substantial amount of capital investment, which creates uncertainty because taxpayers would be taking a risk that their substantial investment may be frustrated by a higher-than-expected emissions value and thus a lower section 45V credit. Instead of requiring a FEED study, the comments suggested a variety of alternatives: (i) a front-end loading (FEL–2) level feasibility study, coupled with a detailed financial model and a lifecycle GHG emissions analysis prepared by a qualified party; (ii) sufficient engineering definition to produce a Class 4 cost estimate, as defined by the Association for the Advancement of Cost Engineering (AACE) International Recommended Practice No. 18R–97; and (iii) exemption from this requirement for certain pathways.

At this nascent stage of the EVRP and after consultation with the DOE, these final regulations retain the requirement for a FEED study but clarify that a taxpayer only needs a Class 3 FEED study or similar indication of project maturity, as determined by the DOE, to apply for an emissions value. Class 3 FEED studies reflect more mature projects than FEED studies of Class 4 or 5, making them more likely to be robust and therefore likely to facilitate faster reviews. Class 3 FEED studies can be conducted sooner in a project and are generally less detailed or time-consuming than a Class 1 or 2 FEED study, addressing the comments' concerns on cost. Further, the DOE advised that Class 3 FEED studies are likely to be conducted by a majority of developers of hydrogen production facilities across pathways, given how complex and capital intensive these facilities are. However, the DOE will continue to explore the feasibility of alternatives to a Class 3 FEED study (for example, a FEED study of a different class) and may identify such alternatives in the future. To the extent the DOE determines that a similar indicator of project maturity would satisfy the requirements of § 1.45V–4(c)(5), such determination will be published by the DOE on its 45V

Emissions Value Request application page. Thus, the provision is adopted as proposed with changes made to clarify that a taxpayer may apply for an emissions value only after it has completed a Class 3 FEED study or other indication of project maturity, as determined by the DOE. The receipt of an emissions value, however, does not constitute a determination that all other requirements for claiming the section 45V credit, including compliance with the anti-abuse and verifiable use rules, are met.

The Treasury Department and the IRS also received many comments on the EVRP generally. Some of these comments requested that the Treasury Department and the IRS (in conjunction with the DOE) create an appeals process through which an applicant can challenge their emissions value. A few comments requested that applicants be allowed to revise or supplement their emissions value request application at various stages of the application process. Some comments requested that the DOE allow applicants with multiple facilities to apply for one emissions value. And other comments asked that applicants be able to submit various documents in support of their applications (for example, submitting documents obtained using modeling software or the R&D GREET model).

The DOE has not developed an appeals process or a method for an applicant to unilaterally revise or supplement their application. However, an applicant may submit additional information to the DOE before the DOE has completed its analysis or after it has determined the facility's emissions value. These final regulations provide that applicants seeking a new emissions value after the DOE has completed its analysis may reapply only if they wish to resubmit their application with new or revised technical information or clarifications related to the information previously submitted. If the applicant's resubmissions result in the applicant receiving multiple emissions values from the DOE for a given hydrogen production pathway, the applicant should use the value that aligns with the information the applicant provided to the DOE with respect to the facility's operations in support of the application that resulted in the emissions value used The DOE will evaluate emissions value request applications using information provided by applicants coupled with background data in 45VH2–GREET (for example, grid emissions, upstream methane emissions). If background data in 45VH2–GREET evolve, information in the latest version of 45VH2–GREET will be used. As new background data parameters are added to 45VH2–GREET or existing parameters become disaggregated (for example, if regionalized upstream methane parameters are incorporated in lieu of a national average), the DOE may revise the information requested through the EVRP to be consistent with the information required to run 45VH2–GREET. For example, if 45VH2–GREET is modified to include regional upstream methane background assumptions, and to require users to select the region that their natural gas is sourced from, applicants to the EVRP will also be expected to provide information about the region their natural gas is sourced from and will be evaluated using the same regional upstream methane background assumptions.

Some comments expressed concern about the timing and transparency of the EVRP. Regarding timing, the comments expressed concern that submitted requests would have long processing times and that could affect project funding and create delays. These comments suggested that the DOE impose on itself a time limit to process applications, after which time an applicant's emissions value is deemed to be the value determined by the lifecycle GHG emissions analysis attached to their tax return.

The DOE has advised that it endeavors to review requests as quickly as possible. A provision to impose a time limit on the DOE's consideration of emissions value requests could impede an accurate and rigorous review of the requests and would require additional administrative processes. Additionally, because the IRS deems as accepted the emissions value provided by the DOE upon filing, and such deemed acceptance is the Secretary's determination of the PER as provided in proposed § 1.45V–4(c)(4), an accurate and rigorous review is necessary to such a determination. Regarding transparency, the DOE has stated publicly in the Emissions Value Request Application Instructions the variables that drive the timeline for application review, which include the volume of applications around a given pathway, complexity/ease of evaluating the hydrogen production pathway, and the commercial readiness of the pathway. The DOE has advised that it expects to be able to provide additional transparency regarding the timeline required for application review. Any additional information will be published by the DOE on its 45V Emissions Value Request page.

6. Effect of Provisional Emissions Rate

Proposed § 1.45V–4(c)(6) would have provided that a taxpayer may use a PER determined by the Secretary to calculate the amount of the clean hydrogen production credit under section 45V(a) and proposed § 1.45V–1(b) with respect to qualified clean hydrogen produced by the taxpayer at a qualified clean hydrogen production facility beginning with the first taxable year in which a PER determined by the Secretary has been obtained and for any subsequent taxable year during the 10-year period beginning on the date such facility was originally placed in service, provided all other requirements of section 45V are met, and until the lifecycle GHG emissions rate of such hydrogen has been determined (for purposes of section 45V(c)(2)(C)) under the most recent version of 45VH2–GREET (as defined in proposed § 1.45V–1(a)(8)(ii)).

Proposed § 1.45V–4(c)(6) would have further provided that the Secretary's PER determination is not an examination or an inspection of books of account for purposes of section 7605(b) of the Code, and would not preclude or impede the IRS (under section 7605(b) or any administrative provisions adopted by the IRS) from later examining a return or inspecting books or records with respect to any taxable year for which the section 45V credit is claimed. Proposed § 1.45V–4(c)(6) would have provided that a verification report submitted under section 45V(c)(2)(B)(ii) and § 1.45V–5 and any information, representations, or other data provided to the DOE in support of an emissions value request would still be subject to IRS examination. Further, proposed § 1.45V–4(c)(6) would have stated that a PER determination would not mean that the IRS has determined that all the requirements of section 45V have been satisfied for any taxable year, nor would it create an inference that such a presumption exists.

Some comments asked the Treasury Department and the IRS to allow optionality between using the PER process or 45VH2–GREET, claiming that the optionality would provide more flexibility and certainty for hydrogen producers. Other comments asked for the creation of a ''safe harbor'' rule, allowing taxpayers to continue using their PERs in cases where their pathway was incorporated into 45VH2–GREET and the model calculated a higher emissions rate than the taxpayers' respective PERs. These comments also claimed that a ''safe harbor'' rule would provide certainty and alleviate any unfairness that may come from having

a higher emissions rate with 45VH2–GREET than with a PER.

The Treasury Department and the IRS recognize that a taxpayer's inability to estimate with a high degree of certainty the amount of section 45V credit—due to the possibility that their hydrogen production pathway will be subsequently included in 45VH2–GREET, which might reflect a higher lifecycle GHG emissions rate than their PER—could affect a taxpayer's efforts to obtain financing for a hydrogen production facility. Allowing taxpayers to lock-in a PER in all instances, however, would be inconsistent with the statute. Section 45V(c)(1)(B) provides that lifecycle GHG emissions shall be determined using the most recent version of the GREET model or a successor model, as determined by the Secretary. Section 45V(c)(2)(C) provides: ''In the case of any hydrogen for which a lifecycle greenhouse gas emissions rate has not been determined for purposes of this section, a taxpayer producing such hydrogen may file a petition with the Secretary for determination of the lifecycle greenhouse gas emissions rate with respect to such hydrogen.'' Section 45V(c)(2)(C) is a conditional sentence. For a taxpayer to be eligible to petition the Secretary for a PER, the taxpayer must meet the condition of producing hydrogen for which a lifecycle GHG emissions rate has not been determined (that is, hydrogen whose technology or feedstock is not in 45VH2–GREET). Likewise, for a taxpayer to be eligible to continue using a PER, the taxpayer's technology or feedstock must not be in 45VH2–GREET. Allowing optionality or creating a safe harbor rule in this case would mean ignoring the condition set by Congress. Therefore, these final regulations do not adopt these comments.

Following the confines of the statute, these final regulations clarify in § 1.45V–4(c)(6)(i) that taxpayers may continue to use the PER determined by the Secretary under § 1.45V–4(c)(4) to calculate the amount of the section 45V credit with respect to qualified clean hydrogen produced at a qualified clean hydrogen production facility, provided that (1) the lifecycle GHG emissions rate of such hydrogen has not been determined (for purposes of section 45V(c)(2)(C)) under the 45VH2–GREET Model (as described in § 1.45V–4(c)(2)(ii)) (subject to the exception in § 1.45V–4(c)(6)(iv)); (2) there are no material changes to the information about the taxpayer's hydrogen production process from the information provided to the DOE to obtain an emissions value pursuant to § 1.45V–4(c)(2)(i), and (3) all other requirements of section 45V are met. These final regulations further clarify in § 1.45V–4(c)(6)(ii) that a ''material change'' means any change that would cause a qualified verifier (as defined in § 1.45V–5(h)) to be unable to complete a production attestation under section 45V(c)(2)(B)(ii) and § 1.45V–5(c).

Further, § 1.45V–4(c)(6)(iii)(A) is added to provide that the taxpayer may, in its discretion, make an irrevocable election effective for the remaining taxable years within the period described in section 45V(a)(1), to treat the version of 45VH2–GREET in which the taxpayer's qualified clean hydrogen production facility's hydrogen production pathway is first included as the 45VH2–GREET Model. The final regulations also add § 1.45V–4(c)(6)(iii)(B) to provide that the taxpayer makes the election with respect to a qualified clean hydrogen production facility on Form 7210 for the taxable year in which the taxpayer's qualified clean hydrogen production facility's hydrogen production pathway is first included in 45VH2–GREET. Changes have also been made to § 1.48–15(d) to provide a corresponding subsequent inclusion safe harbor election with respect to a specified clean hydrogen production facility.

Finally, § 1.45V–4(c)(6)(iv) is added to provide a special rule for taxpayers who received an emissions value from the DOE prior to beginning construction of their respective facility. This rule allows a taxpayer to continue relying on its PER, despite the rate having been determined under the 45VH2–GREET Model. Section 1.45V–4(c)(6)(iv) provides that, notwithstanding the requirement of § 1.45V–4(c)(6)(i)(A), a taxpayer who received an emissions value from the DOE with respect to a qualified clean hydrogen production facility pursuant to § 1.45V–4(c)(2)(i) before the date when construction of the facility began, may, in its discretion, continue to use the PER determined by the Secretary and the associated emissions value to calculate the amount of the section 45V credit with respect to qualified clean hydrogen produced at the qualified clean hydrogen production facility for the remainder of the period described in section 45V(a)(1), provided that the taxpayer continues to satisfy the requirements of § 1.45V–4(c)(6)(i)(B) and (C). This special rule is limited to taxpayers who obtained an emissions value before the date when construction of their facility began because these taxpayers began construction in reliance on their PERs. Taxpayers who began construction before obtaining an emissions value did not do so in reliance on their PERs and therefore, as a temporal matter, did not need to lock-in their PERs in order to secure financing to begin construction. This special rule provides parallel treatment to the beginning of construction safe harbor for 45VH2–GREET in § 1.45V–4(b)(2)(i).

D. Use of Energy Attribute Certificates (EACs)

1. In General

Proposed § 1.45V–4(d) would have provided a framework for the use of EACs as the sole means of documenting purchased electricity inputs from specific sources and reflecting emissions impacts of that electricity used in the production of hydrogen for purposes of the section 45V credit. Under this framework, a taxpayer must acquire and retire qualifying EACs to establish, for purposes of section 45V, that it acquired for use electricity from a specific electricity generation facility (and therefore did not rely on the electricity generally sourced via the regional electricity grid). The framework would have required taxpayers to acquire and retire EACs that meet requirements for incrementality, temporal matching, and deliverability (qualifying EAC requirements), as provided in proposed § 1.45V–4(d)(3). These final regulations generally adopt the qualifying EAC framework of the proposed regulations, with the modifications noted in this part III.D of this Summary of Comments and Explanation of Revisions.

Proposed § 1.45V–4(d)(1) would have provided that for purposes of section 45V, if a taxpayer determines a lifecycle GHG emissions rate for hydrogen produced at a hydrogen production facility using the most recent version of 45VH2–GREET (as defined in proposed § 1.45V–1(a)(8)(ii)) or a PER (as defined in proposed § 1.45V–4(c)(1)), then the taxpayer may reflect in 45VH2–GREET or include in a PER such hydrogen production facility's use of electricity as being from a specific electricity generating facility rather than being from the regional electricity grid (as represented in 45VH2–GREET) only if the taxpayer acquires and retires a qualifying EAC (as defined in proposed § 1.45V–4(d)(2)(iv)) for each unit of electricity that the taxpayer claims from such source. For example, one megawatt-hour of electricity used to produce hydrogen would need to be matched with one megawatt-hour of qualifying EACs. Further, proposed § 1.45V–4(d)(1) would have provided that in order to satisfy this requirement, a taxpayer's acquisition and retirement

of qualifying EACs must also be recorded in a qualified EAC registry or accounting system (as defined in proposed § 1.45V–4(d)(2)(iv)) so that the acquisition and retirement of such EACs may be verified by a qualified verifier (as defined in proposed § 1.45V–5(h)).

With respect to the requirement that each unit of electricity used to produce hydrogen needs to be matched with the electricity represented by the qualifying EACs, in the proposed regulations the Treasury Department and the IRS specifically requested comment as to whether a different treatment would be more appropriate to account for transmission and distribution line losses. For example, taxpayers could be required to adjust the electricity represented by the qualifying EAC downward to account for such losses, which would necessitate buying additional qualifying EACs to make up for the adjustment. Some comments supported the approach of the proposed regulations to not impose a downward adjustment of EACs because granular geographic matching would already mitigate transmission and distribution line losses. Other comments agreed there should be no downward adjustment to EACs, expressing administrability concerns that an adjustment to an EAC to account for losses would vary depending on the taxpayer's location. In contrast, other comments countered that an adjustment should be made to account for transmission and distribution line losses, to accurately determine electricity usage and GHG emissions, unless the hydrogen production facility can provide sufficient documentation that shows that no losses have occurred. These comments posit that not requiring an adjustment could cause a mismeasurement of GHG emissions, by failing to take into account the electricity used to make up for such losses. In response to these comments, the Treasury Department and the IRS, after consultation with the DOE and the EPA, note that existing EAC markets—including markets where purchasers buy EACs to comply with Clean Energy Standards (CES) or Renewable Portfolio Standards (RPS) as well as those where purchasers voluntarily choose to buy EACs—use EACs to enable end-use claims on a one-to-one basis. As noted by the comments, accounting for transmission and distribution line losses also would pose administrability challenges for taxpayers and for verification given uncertainty regarding appropriate assumptions to account for such losses. For these reasons, these final regulations maintain standard practice and therefore retain the one-to-one rule of the proposed regulations. Given the increased accuracy that accounting for such losses would provide, the Treasury Department and the IRS may revisit this requirement if the administrability and verification challenges abate.

Several comments asked that the final regulations state that distributed energy resources may generate qualifying EACs. One of these comments proposed clarifying that all resources that qualify for wholesale bidding under Federal Energy Regulatory Commission (FERC) Order No. 2222, *Participation of Distributed Energy Resource Aggregations in Markets Operated by Regional Transmission Organizations and Independent System Operators* (85 FR 67094), may generate EACs. In response, the Treasury Department and the IRS confirm that distributed energy resources that are grid connected or are directly connected to a hydrogen production facility may generate qualifying EACs, provided that the requirements of § 1.45V–4(d) are met.

Several comments asked for exceptions to the EAC framework, under which a taxpayer could establish the use of electricity from a specific electricity generation source without the acquisition and retirement of qualifying EACs. Another comment proposed allowing the use of power purchase agreements as an alternative to the EAC framework. Similarly, several comments suggested exempting any hydrogen production facility with its own behind-the-meter source of clean electricity (for example, a directly connected hydrogen production facility) from the EAC framework.

In response to these comments, the Treasury Department and the IRS note that the EAC framework is necessary to prevent double counting of the energy and emissions attributes represented by EACs and to mitigate the risk of significant indirect emissions. As explained in part V.C of the Explanation of Provisions to the proposed regulations, the double counting of EACs and their underlying energy and emissions attributes would undermine the integrity of lifecycle GHG emissions rate determinations that incorporate EACs. Double counting occurs if two different parties claim the energy and emissions attributes and associated environmental benefits from generated energy.[17] Uniformly requiring claims of using electricity generated from specific sources to be evidenced by EACs that meet the requirements of § 1.45V–4(d)(1) would mitigate the risk of double counting. Thus, the requirements of the EAC framework must be met regardless of whether the electricity generating facility giving rise to the qualifying EAC is grid connected, directly connected, or co-located with the hydrogen production facility (that is, regardless of whether the underlying source of the qualifying EAC physically supplies electricity through a direct connection to the hydrogen production facility). With respect to behind-the-meter sources of clean electricity, the Treasury Department and the IRS note that many such sources already participate in EAC registries and sell EACs. Even in cases in which the electricity source does not participate in a formal EAC registry, because every unit of electricity generated has tradeable attributes, and because the use of such electricity for hydrogen production can still result in increased emissions, EACs must still be generated and retired. In addition, behind-the-meter sources still pose a risk of induced emissions if such sources involve pre-existing generation that was grid-connected or was used for a purpose other than hydrogen production; such sources would result in induced emissions if they were diverted to hydrogen production. Similarly, making the EAC framework optional or allowing an exception for power purchase agreements raises the possibility of double counting of energy and emissions attributes. While it is possible this concern could potentially be reduced through alternative measures such as a ''no double sale'' attestation made by the electricity source with respect to the attributes, such alternatives would create administrability and coordination problems for sales made outside the EAC framework. In contrast, the required use of the EAC framework described in the proposed regulations provides for a consistent and effective anti-double counting system that is uniform for all taxpayers, regardless of their sources of electricity, and represents standard industry practice across regulatory and voluntary markets. Because of these many reasons, no alternative measures are necessary or appropriate.

Several comments suggested that the Treasury Department and the IRS should explicitly forbid double counting of EACs in the final regulations. One comment was concerned that given the number of EAC registries on the market there would be a high risk of double counting when multiple registries

[17] *Double Counting,* U.S. Environmental Protection Agency, available at *https://www.epa.gov/green-power-markets/double-counting* (last updated Jan. 15, 2024).

substantiate an EAC for the same unit of electricity. While the Treasury Department and the IRS concur that double counting is a risk absent an EAC framework that prevents double counting, the EAC framework of these final regulations is intended to mitigate that risk by requiring qualifying EACs to be tracked in EAC registries and establishing minimum requirements for such registries. The Treasury Department and the IRS are confident that EAC registries can continue to mitigate the risks of double counting in part by working together to ensure that each issued EAC is distinct and unique. In addition, these final regulations modify the requirements for third-party verification to require verifiers to confirm and attest either that electricity generators tied to EACs applied to a particular section 45V credit claim are not registered on multiple qualifying EAC registries, or that, if such generators are registered on multiple qualifying EAC registries, each EAC undergoing verification from each such generator is being issued by only one qualifying EAC registry. This will further reduce double counting risks. *See* § 1.45V–5(c)(2). The final regulations also modify the definition of eligible EAC in § 1.45V–4(d)(2)(iii) to clarify that the EAC must be registered on only one qualified EAC registry or accounting system.

One comment stated that the EAC framework in the proposed regulations does not align with similar frameworks adopted by States through RPS and CES. The comment suggested that the misalignment could lead to double counting and other accounting issues and recommended that the Treasury Department and the IRS align its EAC framework with that of the States. However, the Treasury Department and the IRS do not agree that the EAC framework of the proposed regulations is misaligned with similar frameworks adopted by States through RPS and CES. Under section 45V, hydrogen producers are likely to be able to use the same EAC registries as are employed by the States for purposes of RPS compliance, voluntary markets, and other needs. It is true that the statutory basis of section 45V requires the Treasury Department and the IRS to establish EAC qualifying criteria that are different from State RPS programs. Some of these criteria will require EAC registries to augment their capabilities to ensure that clean hydrogen producers have access to qualifying EACs. However, the Treasury Department and the IRS are confident that if market demand for qualifying EACs exist, EAC registries will develop the necessary functional requirements for EAC tracking to meet that demand. Such development is already occurring. For example, a variety of comments have stated that hourly tracking by 2030 or earlier would be feasible, and several EAC registries have begun to introduce such tracking.

Several comments requested clarification of the extent to which taxpayers can claim the section 45V credit while availing themselves of other incentive programs that also require the acquisition and retirement of EACs. For example, one comment requested clarification that an EAC can be used to satisfy both section 45V requirements and the California Low Carbon Fuel Standard (CA LCFS). In response to these comments, the Treasury Department and the IRS re-affirm that double counting of EACs is disallowed. EACs may not be acquired and retired for purposes of the EAC framework of section 45V if they are separately acquired and retired for any other purpose. However, taxpayers may take advantage of section 45V concurrently with State incentive and other programs in other ways, at the discretion of State policymakers. For instance, hydrogen credited by section 45V may be an eligible fuel in CA LCFS (to the extent this is allowed by California's rules). In addition, the treatment within State programs of clean electricity, the EACs of which have been acquired and retired for hydrogen production under section 45V, is a matter of State policy.

One comment asked that the final regulations allow for relief from filing deadlines if a taxpayer is unable to comply with the EAC framework due to a delay, such as with third-party verification. The comment suggested that because the verification process is new and untested, there should be an accommodation process for producers that are unable to file or amend their returns prior to the close of the section 6511(a) statute of limitations on filing a claim for credit or refund. The Treasury Department and the IRS are aware that taxpayers may encounter unforeseeable compliance issues. The section 45V credit may be claimed on an amended return or AAR, as with other credits, subject to the section 6511(a) statute of limitations noted by the comment. Part IV.K of this Summary of Comments and Explanation of Revisions explains further clarifications to the third-party verification rules of proposed § 1.45V–5(k)(2), that such verification, so long as it is made prior to the date the amended return or AAR is filed, is considered timely. Accordingly, these final regulations do not provide the requested filing relief at this time, but the Treasury Department and the IRS will continue to monitor the compliance concerns raised by the comment.

The same comment requested that hydrogen producers that acquire EACs from a qualified EAC registry or accounting system in good faith be permitted to rely on the EACs and not be held accountable for errors or inaccuracies in such information after the fact. In response, the Treasury Department and the IRS again note that the EAC framework is intended to mitigate double counting and other errors. To the extent the comment requests a safe harbor for the information contained in any acquired EAC, these final regulations do not adopt the comment, as the creation of such a safe harbor would require the Treasury Department and the IRS to determine what constitutes good faith. In response to the comment's concern about errors with respect to EACs, § 1.45V–4(d)(2)(viii) of the final regulations provides standards that a qualified EAC registry or accounting system must meet, and the Treasury Department and the IRS expect that registries meeting these standards will help ensure a high degree of accuracy with respect to their qualifying EACs.

Finally, a number of comments raised questions with respect to how the EAC framework and qualifying EAC requirements relate to hydrogen produced using renewable natural gas or fugitive methane. These comments are addressed in the general discussion of hydrogen produced using RNG or fugitive methane, in part III.H of this Summary of Comments and Explanation of Revisions.

2. Definitions

Proposed § 1.45V–4(d)(2) included definitions for the terms (i) ''commercial operations date;'' (ii) ''energy attribute certificate;'' (iii) ''eligible EAC;'' (iv) ''qualifying EAC;'' (v) ''qualified EAC registry or accounting system;'' and (vi) ''region.'' These terms are retained in these final regulations. The final regulations also add the new definitions of (i) ''qualifying electricity decarbonization standard;'' (ii) ''qualifying GHG cap program;'' (iii) ''merchant nuclear reactor''; (iv) ''qualifying nuclear reactor;'' (v) ''written binding contract;'' and (vi) ''qualifying State,'' which are discussed in part III.D.3.b of this Summary of Comments and Explanation of Revisions. The paragraphs of § 1.45V–4(d)(2) are renumbered in these final regulations to account for these additional terms.

These final regulations amend the definition of eligible EACs and provide additional requirements for electricity sources that use carbon capture technology (discussed in part III.D.3.b.ii of the Summary of Comments and Explanation of Provisions).

The Treasury Department and the IRS received several comments concerning the proposed definitions. Proposed § 1.45V–4(d)(2)(iii)(C) would have required an EAC (as defined in proposed § 1.45V–4(d)(2)(i)) to provide a ''commercial operations date'' or ''COD'' to be an ''eligible EAC.'' Proposed § 1.45V–4(d)(2)(i) would have defined COD as the date on which a facility that generates electricity begins commercial operations. The COD, as defined here, would be the first date of the operation of the relevant electricity generating facility. The general rules for determining an electricity generating facility's placed in service date for Federal income tax purposes would not have applied in determining its COD.

One comment noted that the Western Renewable Energy Generation Information System (WREGIS) [18] database does not currently track the COD of electricity generation facilities and asked the requirement to provide a COD be removed from the definition of eligible EAC. The comment suggested that the final regulations instead rely on qualified verifiers to determine the COD. The Treasury Department and the IRS disagree that COD is not tracked in WREGIS. The COD of each generator is available in the WREGIS database and linked to a project identification. Therefore, the final regulations do not adopt this comment.

Proposed § 1.45V–4(d)(2)(v) would have defined ''qualified EAC registry or accounting system'' to mean a tracking system that (i) assigns a unique identification number to each EAC tracked by such system, (ii) enables verification that only one EAC is associated with each unit of electricity, (iii) verifies that the underlying attributes of each EAC is claimed and retired only once, (iv) identifies the owner of each EAC, and (v) provides a publicly accessible view (for example, through an application programming interface) of all currently registered electricity generators in the tracking system to prevent the duplicative registration of such generators. Many comments called for the Treasury Department and the IRS to develop standardized rules for EAC registries. Several comments suggested adoption of the ''EnergyTag'' standard would prevent fraud, enhance auditability, facilitate registry interoperability, and provide application programming interface access features as well as cybersecurity standards.

In response to these comments, the Treasury Department and the IRS note that rules of proposed § 1.45V–4(d)(2)(v), finalized herein under § 1.45V–4(d)(2)(viii), provide a set of standardized requirements that EAC registries must satisfy. These final regulations do not provide specific rules prescribing the standards that EAC registries must follow to satisfy these requirements. A single standard, while desirable, is not adopted due to lack of sufficient consensus among EAC registries and their participants. Further, adopting a single standard could have unintended consequences and unnecessarily burden or exclude certain EAC registries. The Treasury Department and the IRS, however, encourage EAC registries and external stakeholders to work together to develop such standards. The proposed regulations noted that qualified EAC registries currently include, but are not necessarily limited to, the following: Electric Reliability Council of Texas (ERCOT); Michigan Renewable Energy Certification System (MIRECS); Midwest Renewable Energy Tracking System, Inc. (M–RETS); North American Registry (NAR); New England Power Pool Generation Information System (NEPOOL–GIS); New York Generation Attribute Tracking System (NYGATS); North Carolina Renewable Energy Tracking System (NC–RETS); PJM Generation Attribute Tracking System (PJM–GATS); and WREGIS. The Treasury Department and the IRS continue to expect that these registries will be qualified EAC registries as defined in § 1.45V–4(d)(2)(viii) of the final regulations but note that these registries currently do not generally issue or track EACs that meet the hourly tracking requirements of § 1.45V–4(d)(3)(ii)(A) of the final regulations.

One comment emphasized that EAC registries are currently not fully developed for use with respect to section 45V and noted that many of the identified qualified EAC registries do not track all electricity sources. In response, the Treasury Department and the IRS recognize that the section 45V final regulations will require EAC registries to develop new capabilities. For instance, some EAC registries do not track all forms of electricity, and hourly tracking capabilities are just being developed. However, the EAC registry rules established in these final regulations ensure consistency with the section 45V statutory requirements, including its requirement to determine lifecycle GHG emissions rates, which includes addressing significant indirect emissions such as potential induced emissions. In addition, the Treasury Department and the IRS anticipate that EAC registry rules in these final regulations, and industry interest in complying with requirements for securing the tax credit, will provide a significant market incentive for registries to enhance their capabilities to meet the needs of the clean hydrogen industry. The Treasury Department and the IRS also note that there is substantial interest from a broad cross-section of electricity consumers, including but not limited to hydrogen production facilities, in the development of these same capabilities to enable voluntary market claims related to hourly matching of clean electricity. The Treasury Department and the IRS encourage EAC registries to work together and with stakeholders to develop appropriate, common approaches to enhancing the ability of EAC registries to provide additional, reliable tracking information, and are confident that the new capabilities can be developed by the EAC registries to facilitate compliance with section 45V and accelerate the growth of clean hydrogen production.

Finally, the Treasury Department and the IRS received comments with respect to the definition of ''region'', which are addressed in response to comments received regarding deliverability in proposed § 1.45V–4(d)(3)(iii) in part III.D.3.d of this Summary of Comments and Explanation of Revisions.

3. Qualifying EAC Requirements

a. In General

Proposed § 1.45V–4(d)(3) would have provided that an EAC meets the requirements to be a qualifying EAC if it meets the qualifying EAC requirements for incrementality, temporal matching, and deliverability. A taxpayer is not required to acquire and retire qualifying EACs. However, the taxpayer may only reflect in 45VH2–GREET or include in a PER the taxpayer's use of electricity as being from a specific electricity generating facility (rather than being from the regional electricity grid) if the taxpayer acquires and retires qualifying EACs. *See* proposed § 1.45V–4(d)(1).

Many comments supported these requirements. Generally, these comments agreed that the qualifying EAC requirements are necessary to ensure that electricity consumption

[18] WREGIS was identified as a qualified EAC registry in the Explanation of Provisions to the proposed regulations. *See* Proposed § 1.45V–4, 88 FR 89220, 89228 (Dec. 26, 2023).

associated with hydrogen production, and particularly with electrolytic hydrogen production and other electricity-intensive hydrogen production pathways, do not result in significant induced grid emissions that would disqualify the hydrogen production from the tax credit under the statute. Comments also stated that the qualifying EAC requirements are the best way to adhere to the statutory requirements of section 45V(c)(1). One comment stated that the proposed regulations' interpretation of section 211(o)(1)(H) of the Clean Air Act aligned with both section 45V and the EPA's interpretation. Another comment suggested that the proposed regulations' accounting of induced grid emissions is consistent with longstanding interpretation by the EPA with respect to the Clean Air Act, about which Congress was aware when section 45V was enacted.

On the other hand, many comments criticized the qualifying EAC requirements. Several comments contended that the qualifying EAC requirements lack legal support in section 45V and fail to align with congressional intent. These comments questioned the underlying policy rationale. Comments also criticized the concept of ''induced grid emissions.'' One comment argued that neither section 45V, the Clean Air Act, nor any other Federal statute identifies the risk of ''induced grid emissions'' as a basis for imposing the qualifying EAC requirements.

After consideration of these comments, these final regulations retain the qualifying EAC requirements. The consideration of significant indirect emissions, which in this context includes induced grid emissions, is required by section 45V. Section 45V(c)(1) defines the term ''lifecycle greenhouse gas emissions'' to have the same meaning as that under section 211(o)(1)(H) of the Clean Air Act, limited to include only emissions through the point of production (well-to-gate). Section 211(o)(1)(H) of the Clean Air Act provides, in relevant part, that ''[t]he term 'lifecycle greenhouse gas emissions' means the aggregate quantity of greenhouse gas emissions (including direct emissions and *significant indirect emissions* such as significant emissions from land use changes), as determined by the [EPA] Administrator, related to the full fuel lifecycle'' (emphasis added). Thus, not considering significant indirect emissions related to the full lifecycle of the fuel (including the electricity used to produce the hydrogen) in the determination of a lifecycle GHG emissions rate for a hydrogen process would be contrary to the statute.

As noted in the Explanation of Provisions of the proposed regulations, the Treasury Department and the IRS consulted with the EPA and the DOE to develop the qualifying EAC framework. The EPA advised that, based on its prior implementation of section 211(o)(1)(H) of the Clean Air Act in the context of the RFS, it would be reasonable for the Treasury Department and the IRS to determine that induced grid emissions are an anticipated real-world result of electrolytic hydrogen production that constitute significant indirect emissions and must therefore be considered in lifecycle GHG analyses for purposes of the section 45V credit.[19] As the EPA December 2023 Letter explained, ''[e]lectricity users, including hydrogen producers, can cause or induce emissions by adding new load and consuming electricity. Because the grid must always balance electricity demand with supply, this increased electricity demand results in increased electricity supply and, if the new electricity is not zero-emitting, additional emissions from the grid.'' As induced grid emissions are not currently included in the emissions calculations provided by any version of GREET, the use of qualifying EACs as a means to consider induced GHG emissions is a reasonable methodological proxy in lieu of calculating these emissions as part of the LCA assessment.

The EPA also noted that EACs are an established means for documentation and verification of the generation and purchase of zero-GHG-emitting electricity. Moreover, the EPA advised that, in the context of electrolytic hydrogen, EACs that possess specific attributes that meet certain criteria are an appropriate way in the context of section 45V of verifying the generation and delivery of zero GHG-emitting electricity and can serve as a reasonable methodological proxy for quantifying induced grid emissions associated with new load from electrolytic hydrogen production being added to an existing grid. Such requirements would mitigate the risk of inappropriately crediting hydrogen production that does not meet the lifecycle GHG levels required by section 45V.

The development of the qualifying EAC requirements and framework was also informed by a 2023 DOE technical paper (DOE Technical Paper).[20] As discussed therein, incrementality, temporal matching, and deliverability requirements are important guardrails to ensure that hydrogen producers' electricity use can be reasonably deemed to reflect the emissions associated with the specific generators from which the EACs were purchased and retired. If hydrogen producers rely on EACs without attributes that meet these three criteria there is a significant risk that hydrogen production would significantly increase direct and significant indirect GHG emissions—and, in particular, induced grid emissions—beyond the levels required to qualify for the section 45V credit.

Based on advice of the DOE and the EPA, the proposed regulations included the qualifying EAC requirements. Upon consideration of the comments received, these final regulations retain the requirements. The qualifying EAC requirements are indeed necessary to address the risk of significant indirect emissions associated with electricity use for purposes of the section 45V credit. Electricity from a specific generator will have a GHG emissions profile that results from both its direct and indirect emissions. Requiring EACs with attributes that meet the three criteria is necessary to address and prevent, to the extent reasonably practicable, indirect GHG emissions resulting from the dynamics of the electricity market and the electric grid and fulfill the statute's directive to only award the section 45V credit to hydrogen production with lifecycle GHG emissions within specified levels.

Section 45V(c)(1) and section 211(o)(1)(H) of the Clean Air Act require the consideration of *significant* indirect emissions. A few comments questioned how the induced indirect emissions from the use of electricity to produce hydrogen are significant. Some stated that modeling should be done to determine if indirect emissions are significant. Other comments included analysis and modeling, finding that induced grid emissions will often be large enough to affect whether a project qualifies for the section 45V credit or what tier of the credit it qualifies for, indicating that these emissions are significant.

In response, the Treasury Department and the IRS note that whether emissions are significant must be understood

[19] *See* Letter from Janet McCabe, Deputy Administrator, U.S. Environmental Protection Agency, to Lily Batchelder, Assistant Secretary for Tax Policy, U.S. Department of the Treasury (Dec. 20, 2023), available at *https://home.treasury.gov/system/files/136/45V-NPRM-EPA-letter.pdf* (EPA December 2023 Letter).

[20] *See* U.S. Department of Energy, *Assessing Lifecycle Greenhouse Gas Emissions Associated with Electricity Use for the Section 45V Clean Hydrogen Production Tax Credit* (Dec. 19, 2023), available at *https://www.energy.gov/45vresources* (scroll to ''45V White Paper;'' then click ''Read and download the 45V White Paper'').

within the structure of section 45V. For purposes of section 45V, the specific amount of emissions determine whether hydrogen produced is qualified clean hydrogen (with a lifecycle GHG emissions rate of not greater than 4 kilograms of CO2e per kilogram of hydrogen) and what applicable percentage, and therefore amount of credit, the taxpayer may qualify for. *See* Section 45V(b) and (c)(2). In this statutory context, any indirect emissions may be significant, because such emissions could affect the qualification for, and amount of, the section 45V credit. In addition, the Treasury Department and the IRS note that the DOE advised that ''electrolysis projects that use grid electricity have the potential to be several times more GHG intensive than the threshold for the lowest value § 45V tax credit tier (*i.e.,* 4 kg of CO2e/kg H2), and could be more GHG intensive than existing forms of conventional hydrogen production.'' [21] Further, the EPA advised in the EPA December 2023 Letter that ''publications have noted that electrolysis projects that use large amounts of grid electricity to produce hydrogen have the potential to be several times more greenhouse-gas intensive than the threshold for even the lowest value IRC section 45V tax credit tier, and could in fact be more greenhouse-gas intensive than existing forms of conventional hydrogen production.'' [22] For example, one study found that subsidized grid-connected hydrogen production has the potential to induce additional emissions at effective rates worse than those of conventional, fossil-based hydrogen production pathways and that hydrogen electrolysis with no incrementality requirement would cause GHG emissions rates at nearly 20 kilograms of CO2e per kilogram of hydrogen in an 82 percent carbon-free California power grid in 2030.[23] Another study found that electrolysis using non-additional clean energy would incur 22 to 40 kilograms of CO2e per kilogram of hydrogen across all 14 modeled regions comprising the 48 contiguous U.S. states and the District of Columbia.[24] Another study assessed the impact on GHG emissions of electrolytic hydrogen production without an incrementality requirement and found that this could increase emissions by 73 million metric tons in 2030.[25] Further, the level of induced grid emissions is expected to often be large enough to disqualify hydrogen production from credit eligibility or, at minimum, affect which level of credit the production is eligible for. Based on the evidence, the Treasury Department and the IRS are statutorily required under section 45V to consider induced grid emissions as ''significant indirect emissions,'' consistent with the EPA's previous interpretation of that term in section 211(o)(1)(H) of the Clean Air Act.[26]

Many of the comments that criticized the qualifying EAC requirements and framework also raised concerns about the effect that the requirements may have on industry. For example, some comments opposed the requirements on the grounds that they exacerbate challenges that already exist in getting hydrogen production projects underway, such as higher costs related to debt, materials, and labor, as well as competition to electrolytic hydrogen from other types of fuel production processes. Similarly, one comment claimed that the proposed qualifying EAC requirement framework would significantly increase the production cost of the lowest carbon-intensity hydrogen. Other comments claimed that the regulatory costs outweigh the emissions benefits. Comments also stated that implementing the qualifying EAC requirements could cause a significant expansion of renewable energy generation sources without regard to existing generation sources and therefore artificially accelerate the development of such sources; this may cause problems if the development does not also address reliability concerns of a particular region's infrastructure.

In contrast, several other comments stressed the importance of maintaining the rigor of the qualifying EAC requirements and cautioned that any flexibility should be done with care and consideration to ensure that the intended purpose of the qualifying EAC requirements is not undermined. One comment urged that the final regulations maintain the strictness of the qualifying EAC requirements for purposes of determining section 45V credit eligibility to ensure that hydrogen producers are properly incentivized and constrained to utilize the section 45V credit for the generation of qualified clean hydrogen. Some supportive comments, despite acknowledging the challenges of meeting the requirements of the qualifying EAC requirements in the near term, claimed that electricity meeting the qualifying EAC requirements is likely to be available in vast quantities. These comments generally contended that the qualifying EAC framework will make electrolytic hydrogen production economically beneficial and environmentally sustainable.

As noted previously in this part of the Summary of Comments and Explanation of Revisions, the qualifying EAC requirements address the risk of significant indirect emissions associated with electricity used in the production of hydrogen for purposes of the section 45V credit. The comments outlined in this part reflect different views on how the consideration of significant indirect emissions may affect the hydrogen industry. The section 45V credit incentivizes certain hydrogen production, but subject to limitations regarding the level of lifecycle GHG emissions. One of those limitations is the statutory requirement to take into account significant indirect emissions. Therefore, the recommendation to eliminate the qualifying EAC requirements is not adopted by these final regulations because it would fail to address such emissions.

While some comments advocated for abandoning the qualifying EAC requirements in their entirety, other comments suggested modifications, such as by giving hydrogen producers more time to adjust or allowing greater flexibility in sourcing the electricity used. They also emphasized the need for such modifications to ensure that the qualifying EAC requirements do not create an uneven playing field across regions, disadvantage existing clean electricity generators, or have the effect of incentivizing only non-electrolytic, fossil-fuel-based hydrogen production.

The Treasury Department and the IRS have considered these comments, and these final regulations make adjustments to each of the qualifying EAC requirements to provide additional flexibility, while continuing to adhere to the statutory requirements of section 45V. These final regulations adopt certain alternative rules under the incrementality requirement of proposed § 1.45V–4(d)(3)(i) that reflect situations

[21] DOE Technical Paper *supra* note 20.

[22] EPA December 2023 Letter *supra* note 19 (citing U.S. Department of Energy, *Pathways to Commercial Liftoff: Clean Hydrogen* (2023), at 10–12, available at *https://liftoff.energy.gov/wp-content/uploads/2023/05/20230523-Pathways-to-Commercial-Liftoff-Clean-Hydrogen.pdf*).

[23] Wilson Ricks et al., *Minimizing Emissions from Grid-Based Hydrogen Production in the United States,* 18 Environmental Research Letters, no. 1, Jan. 2023, available at *https://iopscience.iop.org/article/10.1088/1748-9326/acacb5/pdf.*

[24] Dan Esposito et al., *Smart Design of 45V Hydrogen Production Tax Credit Will Reduce Emissions and Grow the Industry,* at 19 (Apr. 2023), available at *https://energyinnovation.org/wp-content/uploads/Smart-Design-Of-45V-Hydrogen-Production-Tax-Credit-Will-Reduce-Emissions-And-Grow-The-Industry.pdf.*

[25] The study notes this figure assumes no improvement in grid carbon intensity over time. Ben King et al., *Scaling Green Hydrogen in a Post-IRA World,* Rhodium Group (Blog) (Mar. 16, 2023), available at *https://rhg.com/research/scaling-clean-hydrogen-ira/.*

[26] *See* EPA December 2023 Letter *supra* note 19.

that do not pose the same risk of induced grid emissions that the incrementality requirement is otherwise needed to address. These alternatives are discussed in more detail in part III.D.3.b.ii through v of the Summary of Comments and Explanation of Revisions. In addition, these final regulations, in response to the comments, delay until 2030 the requirement that temporal matching be hourly (from 2028 in the proposed regulations). This change is discussed in more detail in part III.D.3.c.ii of this Summary of Comments and Explanation of Revisions. These final regulations, however, do not delay the imposition of the qualifying EAC requirements or provide rules that would exempt certain hydrogen producers from those requirements. As previously noted, the qualifying EAC requirements are needed to address the risk that induced grid emissions will otherwise lead to lifecycle GHG emissions rates that are beyond the statutory thresholds. Consideration of significant induced grid emissions and disqualifying hydrogen production above the statutory thresholds is required under section 45V. In addition to addressing induced grid emissions risk, the qualifying EAC framework also is needed to prevent double counting of energy attributes. Furthermore, EACs play a secondary role to inform and verify the feedstock assumptions applied in 45VH2–GREET in estimating the lifecycle emissions of hydrogen production.

One comment recommended an alternative to the qualifying EAC requirements that follows European Union (EU) rules allowing hydrogen production to qualify as green where hydrogen is produced in a region with an average renewable electricity share exceeding 90 percent in the previous calendar year, if the hydrogen production does not exceed the proportion of renewable electricity in the region. Another comment noted that while the EU has exemptions to incrementality, the EU also has an Emissions Trading System that caps consequential emissions that may result from the exemption. In consultation with the DOE, the Treasury Department and the IRS note that the approach taken by the first comment cannot ensure consistency with the 4 kilograms of CO2e per kilogram of hydrogen emissions intensity threshold based on a lifecycle GHG emissions analysis that conforms with section 45V because diverted zero emission electricity generation could still be backfilled with GHG emitting generation. However, these final regulations adopt an incrementality pathway consistent with statutory requirements that looks to features of State law, as discussed in part III.D.3.b.iv of this Summary of Comments and Explanation of Revisions.

Another comment suggested that EACs be required only corresponding to the percentage of electricity purchased by the hydrogen producer that equals the percentage of the total electricity demand of production in the region that is not currently renewable. In response, the Treasury Department and the IRS note that the most reliable way to validate electricity use claims is through the retirement of EACs. Doing otherwise risks the possibility of double sale and counting of energy attributes. Further, as described in the Explanation of Provisions to the proposed regulations, the three qualifying EAC requirements combine to mitigate the risk that induced grid emissions will lead to lifecycle GHG emission rates that are above what is permitted for eligibility for the section 45V credit. If the hydrogen facility's increased electricity load is only partly matched with incremental clean generation, then there can be no assurance that the remaining portion of that increased load has no induced grid emissions (in fact, induced grid emissions would be expected). Such emissions must be considered in estimating the lifecycle GHG emission rate under section 45V.

A number of comments suggested that the regulations allow the use of carbon or emissions matching in lieu of, or as an alternative to, the current EAC framework. One of these comments explained that such an approach would identify the annual emissions induced by the energy consumption of a hydrogen electrolyzer and offset them by at least an equivalent amount of avoided emissions attributable to the procurement of onsite or offsite sources of renewable energy generation. Similarly, several comments proposed that carbon matching or carbon accounting could be used as substitute for certain qualifying EACs. For instance, comments suggested allowing the use of marginal carbon accounting, paired with incrementality, to replace temporal matching and deliverability. In response to these comments, the Treasury Department and the IRS note that the three qualifying EAC requirements are intended to mitigate the risk of significant indirect emissions, including induced grid emissions. As described in the DOE Technical Paper, and supported in multiple comments, the requirements address both operational (short-term) and structural (long-term) effects that can affect lifecycle emissions outcomes. The Treasury Department and the IRS are concerned about the ability to develop a rigorous, fully standardized, and carbon-based accounting system, whereas the EAC qualifying criteria have already been established, is consistent with standard industry practice for the voluntary market and most State regulatory programs, and will be readily administrable on a nationwide basis.

Several comments were not convinced of the viability of EACs and the qualifying EAC requirements, and questioned models and scenarios that are used to justify the viability of the requirements. Whereas some comments requested exemptions from the qualifying EAC requirements, other comments requested delays in implementation. Requests for exemptions addressed specific technologies or feedstocks, specific electricity generators, certain types of hydrogen production facilities, certain reliance periods, and certain jurisdictions or regions. Some comments requested a specific exception from the qualifying EAC requirements where the hydrogen production facility uses electricity to produce hydrogen and such electricity generating facility is directly connected with the hydrogen production facility (that is, behind-the-meter). One comment suggested that the qualifying EAC requirements should not apply in their entirety if a hydrogen production facility uses electricity generated by a facility that qualifies for either the section 45Y credit or the section 48E credit. Many comments requested reliance rules (sometimes referred to in comments as ''grandfathering'') with respect to some or all of the qualifying EAC requirements, for hydrogen production facilities with a beginning-of-construction date, placed in service date, or commercial-operations date before a certain point.

Comments that recommended that the regulations delay implementing the qualifying EAC requirements due to viability concerns varied considerably. One comment recommended that implementation be based upon meeting defined requirements that establish viability of imposing qualifying EAC requirements. Other comments suggested a variety of proposed timelines for implementation.

In contrast, other comments urged that the final regulations should not provide any exemptions from or delays in implementation. Some comments advocated for an accelerated timeline for implementing the qualifying EAC

requirements to reduce the risk of induced grid emissions, and urged that delays be avoided.

In response to these comments, these final regulations do not provide exemptions from the qualifying EAC requirements or delay their application, as such exemptions or delays would lead to induced grid emissions. Section 45V requires that the determination of lifecycle GHG emissions consider significant indirect emissions, and as described earlier, the qualifying EAC requirements are the best available approach for addressing induced grid emissions that could constitute significant indirect emissions given the statutory requirement to use the most recent GREET model or a successor model. Delaying the qualifying EAC requirements would delay the entire regulatory framework that addresses the risk of significant indirect emissions and ensures that the credit is only awarded to hydrogen produced through a process that results in qualifying lifecycle GHG emission rates, which would be in a manner that is contrary to the statute.

With respect to comments' requests for an exception for behind-the-meter generation, these final regulations do not create such an exception. As explained in part III.D.1 of this Summary of Comments and Explanation of Revisions regarding the discussion of the EAC framework, uniformly requiring claims of electricity usage generated from specific sources to be evidenced by EACs that meet the requirements of § 1.45V–4(d)(1) is necessary to mitigate the risks of double counting of electricity attributes and of induced grid emissions that would make the hydrogen production ineligible for the credit or a specific credit level. Because behind-the-meter electricity generating facilities have tradeable attributes that may be sold and because diversion of electricity from these facilities can result in induced emissions, imposing a uniform set of requirements that does not exempt these facilities is the most administrable way to mitigate the risk of double counting and ensure that any induced grid emissions relating to such facilities are addressed.

With respect to requests for a reliance rule, such a rule would function as a limited or complete exemption to the qualifying EAC requirements, and thus would not appropriately address the risk of induced grid emissions for the facilities under such rule. For this reason and because such a reliance rule is contrary to the statute, these final regulations do not to adopt such a rule.

However, as described in this Summary of Comments and Explanation of Revisions, the final regulations provide additional flexibilities within the framework established by the qualifying EAC requirements, consistent with statutory requirements. For example, as described in part III.D.3.c.ii of this Summary of Comments and Explanation of Revisions, these final regulations extend the transition rule regarding the temporal matching requirement to address administrative challenges raised by the comments, while still requiring annual matching during the transition period. Other additional flexibilities are described in parts III.D.3.b.ii through v, III.D.3.c.ii and v, and III.D.3.d.iii.

Finally, comments requested clarification as to whether the qualifying EAC requirements are applicable only to electrolytic hydrogen production or if they also extend to processes that use electricity indirectly in the production of hydrogen, such as, for example, biogenic hydrogen production. In response, the Treasury Department and the IRS clarify that the acquisition and retirement of qualifying EACs is required whenever a taxpayer seeks to treat a hydrogen production facility's use of electricity as being from a specific electricity generating facility rather than being from the regional electricity grid, regardless of the specific production process.

b. Incrementality

i. In General

Proposed § 1.45V–4(d)(3)(i)(A) would have provided that an EAC meets the incrementality requirement if the electricity generating facility that produced the unit of electricity to which the EAC relates has a COD (as defined in proposed § 1.45V–4(d)(2)(i)) that is no more than 36 months before the hydrogen production facility for which the EAC is retired was placed in service. Proposed § 1.45V–4(d)(3)(i)(B) would have provided an alternative test for establishing incrementality for electricity generating facilities that undergo an uprate. Proposed § 1.45V–4(d)(3)(i)(C) would have provided an example to illustrate the application of the alternative test for establishing incrementality due to uprates.

The Treasury Department and the IRS received numerous comments with respect to the incrementality requirement. To the extent that these comments concern the qualifying EAC requirements in general, they are addressed in part III.D.3.a of this Summary of Comments and Explanation of Revisions.

A number of comments addressed the 36-month lookback period for incrementality. Several comments requested that the period be lengthened, to take into account supply chain delays, or otherwise be more flexible. These final regulations do not adopt such changes, which could significantly extend the lookback period. The lookback period rule was meant to balance the need for flexibility, recognizing that it may be hard to perfectly align the placed in service date of the hydrogen producer with the COD of the clean power generator, with the requirement that the lifecycle GHG emissions account for direct and significant indirect emissions, including induced grid emissions. Further extending that lookback period beyond 36 months risks induced grid emissions, as such clean power facilities may not be truly incremental. Furthermore, the Treasury Department and the IRS note that significant new clean power generation is being deployed each year, some of which may be available to hydrogen producers. While permitting and interconnection is time consuming, substantial amounts of new clean power have completed interconnection agreements, so a significant portion of such generation has largely already gone through that process. On balance, the 36-month lookback provides sufficient flexibility while providing a meaningful check against the risk of induced grid emissions and lifecycle GHG emission rates that would be in excess of those allowed by section 45V.

Similarly, other comments stated that the lookback period should begin at the hydrogen production facility's beginning of construction date instead of the facility's placed in service date. The final regulations do not adopt these comments, as they would significantly lengthen the lookback period relative to the point at which the hydrogen production facility actually begins producing hydrogen. Other comments raised issues relating to the retrofitting or repowering of facilities or the 80/20 Rule. These comments are discussed part V.B of the of this Summary of Comments and Explanation of Revisions.

The Treasury Department and the IRS received several comments that stated that the incrementality requirement is against the Congressional purpose of jumpstarting the clean hydrogen industry and is not supported by the statute. These comments also suggested that hydrogen produced using nuclear energy from a nuclear facility that might otherwise retire would mitigate the risk of induced grid emissions. The comments make several statutory arguments. First, they point to the section 45U credit, which was

established by the IRA and applies only to nuclear facilities placed in service prior to the enactment of the IRA. Section 45U(c)(2) incorporates rules set forth in section 45(e)(13) that allow nuclear facilities receiving credits under section 45U to treat the electricity such facilities generate as sold to an unrelated person during the taxable year if such electricity is used by the taxpayer or a person related to the taxpayer at a qualified clean hydrogen production facility to produce qualified clean hydrogen. The comments contend that the incrementality requirement renders section 45U(c)(2) superfluous, as it would prevent the electricity produced by a facility that is eligible for the section 45U credit from being treated as zero-emissions electricity in the production of qualified clean hydrogen. Second, the comments state that an incrementality requirement is inconsistent with the definition of lifecycle GHG emissions in section 45V(c)(1)(A) and section 211(o)(1)(H) of the Clean Air Act, and specifically assert that well-to-gate GHG emissions from nuclear-based hydrogen production are minimal. Third, the comments point out that section 45V contains two provisions that are explicitly limited to facilities of a particular age (section 45V(c)(3)(C) and (e)(2)(A)) and submit that the lack of such an explicit rule with respect to induced grid emissions suggests that the incrementality requirement violates Congressional intent. Fourth, the comments assert that the incrementality requirement violates the major questions doctrine. Finally, these comments state that the incrementality requirement discriminates against electricity produced from nuclear power and that it may jeopardize the viability of the Regional Clean Hydrogen Hubs initiative of the Infrastructure Investment and Jobs Act (Pub. L. 117–58).

In response to these comments, the Treasury Department and the IRS note that the incrementality requirement and qualifying EAC requirements are not mandatory under these final regulations. A taxpayer is not required to acquire and retire qualifying EACs. However, the taxpayer may only reflect in 45VH2–GREET or include in a PER the taxpayer's use of electricity as being from a specific electricity generating facility (rather than being from the regional electricity grid) if the taxpayer acquires and retires qualifying EACs that satisfy the qualifying EAC requirements. The Treasury Department and the IRS disagree with the arguments that the incrementality requirement is inconsistent with the statute. Instead, as explained in part III.D.3.a of this Summary of Comments and Explanation of Revisions, the qualifying EAC requirements, including incrementality, are a reasonable methodological proxy for quantifying induced grid emissions associated with new load from electrolytic hydrogen production being added to an existing grid. The lack of such requirements would fail to provide a method for addressing significant indirect emissions, as required by section 45V(c)(1)(A) and section 211(o)(1)(H) of the Clean Air Act, and so would be inconsistent with section 45V. Furthermore, the incrementality requirement as modified under these final regulations does not render sections 45U(c)(2) and 45(e)(13) superfluous, both because the qualifying EAC requirements are not mandatory, and because, under these final regulations, electricity from certain existing nuclear reactors provides an alternative pathway to incrementality, as discussed in part III.D.3.b.v of this Summary of Comments and Explanation of Revisions. The Treasury Department and the IRS likewise disagree that the incrementality requirement discriminates against nuclear power. As with other facilities, redirecting electricity produced by existing nuclear facilities to hydrogen production can result in induced emissions. For the reasons previously explained, electricity that meets the incrementality requirement does not pose the same risk of induced emissions. In addition, the two provisions in section 45V cited by the comments, which are limited to facilities of a particular age, are unrelated to determining lifecycle GHG emissions and therefore are irrelevant to Congressional intent on this issue. Finally, with respect to comments suggesting the incrementality requirement is incompatible with the major questions doctrine, the Treasury Department and the IRS note that section 45V, consistent with other parts of the IRA, contains several express grants of authority to the Secretary, including under section 45V(f), to issue regulations or other guidance to carry out the purposes of section 45V, including regulations or other guidance for determining lifecycle GHG emissions. As explained previously, the qualifying EAC requirements are integral to the assessment of lifecycle GHG emissions as mandated by section 45V(c)(1) and are thus clearly within the Secretary's authority, as several comments have noted.

The Treasury Department and the IRS agree with the comments that suggest that the use of electricity generated by an existing nuclear facility may, in certain cases, have a limited risk of induced grid emissions. Accordingly, the final regulations adopt an additional incrementality pathway for electricity that is produced by an electricity generation facility that is a qualifying nuclear reactor, which is discussed in part III.D.3.b.v of this Summary of Comments and Explanation of Revisions. The Treasury Department and the IRS also note that a qualifying nuclear reactor that produces electricity used by a hydrogen production facility under this pathway may qualify for the section 45U credit if the requirements for the section 45U credit are otherwise met. One comment raised the issue of ''test'' energy—electricity produced prior to COD. The comment asked that such electricity production be deemed incremental, noting that some EAC registries already issue certificates for test energy. The Treasury Department and the IRS affirm that EACs associated with test energy are allowed and may be considered incremental if the other requirements are met.

In consideration of additional comments received and as discussed in the following parts III.D.3.b.ii through v of this Summary of Comments and Explanation of Revisions, these final regulations modify the general incrementality rule in proposed § 1.45V–4(d)(3)(i)(A) to allow for electricity represented by an EAC that is produced by an electricity generating facility that has placed in service carbon capture and sequestration technology within a certain timeframe. In addition, the final regulations adopt the following additional ways to satisfy the incrementality requirement: (i) an alternative for electricity represented by an EAC that is produced by an electricity generation facility in a qualifying State; and (ii) an alternative for electricity represented by an EAC that is produced by an electricity generation facility that is a qualifying nuclear reactor.

ii. Carbon Capture and Sequestration

The final regulations modify proposed § 1.45V–4(d)(3)(i)(A) and provide that an EAC also meets the incrementality requirement if the electricity represented by the EAC is produced by an electricity generating facility that uses carbon capture and sequestration (CCS) technology and the carbon capture equipment has a placed in service date that is no more than 36 months before the hydrogen production facility for which the EAC is retired was placed in service (CCS retrofit rule). The definition of ''eligible EAC'' in proposed

§ 1.45V–4(d)(2)(iii) is amended to require that the EAC include the placed in service date of the carbon capture equipment used in the production of electricity. In addition, as further discussed in part III.G of this Summary of Comments and Explanation of Revisions, these final regulations add § 1.45V–4(e), which provides that CCS may be taken into account only if the carbon is captured and disposed of in secure geological storage, pursuant to section 45Q(f)(2) and any regulations established thereunder, or utilized in a manner described in section 45Q(f)(5) and any regulations established thereunder. The Treasury Department and the IRS note that an electricity generating facility producing electricity that is represented by an EAC that utilizes the CCS retrofit rule to satisfy the incrementality requirement is subject to this requirement. The Treasury Department and the IRS received several comments on CCS generally, which are discussed in part III.G of this Summary of Comments and Explanation of Revisions. With respect to the incrementality requirement, the Treasury Department and the IRS noted in the proposed regulations that there are circumstances in which an existing higher-emitting electricity generating facility may make upgrades to subsequently deliver electricity with lower emissions. For example, an existing fossil-fuel electricity generating facility may add CCS capability, thereby reducing its emissions. The Treasury Department and the IRS requested comments on whether the electricity generated by such a facility should be considered incremental under circumstances such as if an existing fossil fuel electricity-generating facility after the addition of carbon capture equipment (after upgrade) had a COD that is no more than 36 months before the relevant hydrogen production facility was placed in service. Comment also was requested on the related question whether, depending on its carbon dioxide capture rate, it would be appropriate to treat such a facility as a new source of minimal-emitting generation on the grid that would not be associated with induced grid emissions. Relevant to these questions, the Treasury Department and the IRS requested comments on what information would be needed to allow for qualifying EACs representing existing fossil fuel-powered electricity from facilities that have added carbon capture equipment, and whether there are safeguards that can ensure that a hydrogen producer's purchase and use of electricity from an existing fossil fuel-fired electricity generating facility that installs carbon capture equipment does not result in emissions due to the dynamics of the electricity market and electric grid. Finally, the Treasury Department and the IRS requested comments on the direct and indirect emissions impacts of making such a facility eligible, and whether and under what circumstances it would be appropriate to do so.

The Treasury Department and the IRS received numerous comments in response to these requests. After consideration of these comments and in consultation with the DOE, these final regulations incorporate the CCS retrofit rule under the incrementality requirement. A number of comments supported the adoption of such a rule, many providing qualitative or quantitative arguments for why the induced grid emissions resulting from an existing generating facility retrofitted with CCS would be minimal. In contrast, comments opposed to a CCS retrofit rule stated that the emissions effect of such a rule was uncertain. One comment stated that hydrogen produced by an electricity source using a CCS retrofit would still need to be met by new generation. Another comment noted specifically that any CCS that is legally required should not be deemed incremental.

These final regulations adopt the CCS retrofit rule because an electricity-generating facility retrofit with carbon capture equipment may be considered a new source of lower-carbon supply. Such a plant produces lower emissions by virtue of the addition of CCS, compared to one without CCS, and its EACs will reflect its relevant attributes, as discussed more in part III.D.3.a of this Summary of Comments and Explanation of Revisions.

The Treasury Department and the IRS recognize that section 45V may create incentives for existing fossil fuel electricity generation to place in service carbon capture equipment. New CCS retrofits will generally reduce emissions even in the presence of increased load due to hydrogen production, in part because any increased grid electricity for such increased load is likely to be met by new sources of electricity generation with an equivalent or lower emissions profile than the existing electricity source prior to its retrofit with carbon capture technology. For simplicity and administrability, the CCS retrofit rule ties incrementality to the date the new carbon capture equipment is placed in service. Additionally, these final regulations do not adopt a rule that CCS retrofits mandated by law are not incremental. To do otherwise would be inconsistent with the requirements for other clean generation, which are treated as incremental based on the generating facility's COD regardless of whether that new generation is mandated by law. Determining what is mandated by law is not straightforward, which raises administrability concerns.

Consistent with the comments' recommendations regarding the treatment of new power plants that are equipped with carbon capture equipment (new build CCS), EACs from plants retrofitted with new carbon capture equipment will not have a zero emissions rate, and this information would need to be reflected accordingly in 45VH2–GREET as part of the GHG emissions rate calculation. Rules for such EACs are discussed in part III.D.3.a of this Summary of Comments and Explanation of Revisions.

iii. Uprates

Proposed § 1.45V–4(d)(3)(i)(B) would have provided rules for determining uprated production. Specifically, proposed § 1.45V–4(d)(3)(i)(B) would have provided that an uprated electricity generating facility's production must be prorated to each hour or year, consistent with the requirements in proposed § 1.45V–4(d)(3)(ii), of such facility's generation by multiplying each hour's production by the uprated production rate to determine the electricity to which the uprate relates. Proposed § 1.45V–4(d)(3)(i)(B) would have defined key terms, including: (i) ''uprate,'' which means an increase in an electricity generating facility's rated nameplate capacity (in nameplate megawatts); (ii) ''pre-uprate capacity,'' which means the nameplate capacity of an electricity generating facility immediately before an uprate; (iii) ''post-uprate capacity,'' which means the nameplate capacity of an electricity-generating facility immediately after an uprate; (iv) ''incremental generation capacity,'' which means the increase in an electricity generating facility's rated nameplate capacity from the pre-uprate capacity to the post-uprate capacity; (v) ''uprated production rate,'' which means the incremental generation capacity (in nameplate megawatts) divided by the post-uprate capacity (in nameplate megawatts); and (vi) ''uprated production,'' which means the uprated production rate of an electricity generating facility multiplied by its total generation output in a given hour (in megawatt hours). Thus, the uprated production gets pro-rated over the course of the year during each hour electricity is generated. Proposed § 1.45V–4(d)(3)(i)(C) would have

provided an example to illustrate the application of the alternative test for establishing incrementality due to uprates.

The Treasury Department and the IRS received comments with respect to uprates. Some comments suggested that any uprate used to satisfy the incrementality requirement must be established through approval of an amended or modified operating license or similar approval by a governmental or quasi-governmental agency, such as the Nuclear Regulatory Commission (NRC), FERC, or a regional grid operator. These final regulations do not adopt this as a standalone measurement standard. A sole, general rule requiring modified or amended licenses, or for electricity generating facilities to obtain other forms of governmental approval, is not needed to reasonably capture additions to capacity. Because the uprated production represents new production capacity, it should satisfy the incrementality requirement. In addition, some uprates come from facilities that do not require approval from the NRC, the FERC, or a regional operator.

One comment requested that guidance clarify that uprates or upgrades with respect to a nuclear facility or other zero-emission-generating facility, such as hydropower, satisfy the incrementality requirement provided that the uprate or upgrade results in an incremental increase in the electricity generation output based on the actual productive capability of such facility, after considering degradation and other limitations on its original nameplate, licensed, or rated capacity. The Treasury Department and the IRS acknowledge that measuring capacity using nameplate capacity would, in some cases, not reflect age-based degradation in capacity or certain types of capacity increases.

In response to these comments, these final regulations modify the uprate rules in § 1.45V–4(d)(3)(i)(B) to account for potential differences in the nameplate capacity and the actual productive capacity of the facility. The final regulations provide that the term uprate means the increase in either an electricity generating facility's nameplate capacity (in nameplate megawatts) or its capacity measured by a standard other than nameplate capacity, which the final regulations define as specified capacity. Measurement of specified capacity may be determined using one of three standards: (1) a modified or amended facility license from FERC or NRC, or related reports prepared by FERC or NRC as part of the licensing process; (2) the ISO conditions to measure the nameplate capacity of the facility consistent with the definition of ''nameplate capacity'' provided in 40 CFR 96.202; or (3) a measurement standard as determined by the Secretary in guidance published in the *Internal Revenue Bulletin*. See § 1.45V–4(d)(3)(i)(B)(*3*). The final regulations provide that if a taxpayer is able to determine a measurement standard based on a modified or amended license from FERC or the NRC as part of the licensing process, they may not use the standard based on ISO conditions. Such a rule should provide sufficient flexibility to taxpayers in determining uprated production. Similarly, the definitions of ''pre-uprate capacity'' and ''post-uprate capacity'' are modified to include specified capacity.

Another comment recommended that uprated production not be subject to a 36-month lookback period. However, as the absence of a lookback period would result in induced grid emissions that would need to be reflected in the lifecycle GHG emissions rate, these final regulations do not adopt this comment.

The final regulations renumber the general rule as § 1.45V–4(d)(3)(i)(B)(*1*), include a new rule for restarts as § 1.45V–4(d)(3)(i)(B)(*2*), and retain the example as § 1.45V–4(d)(3)(i)(B)(*4*).

The final regulations also delete the word ''immediately'' from the definitions of ''pre-uprate capacity'' and ''post-uprate capacity,'' in order to provide clarity. A time-period limitation is not necessary, and the word ''immediately'' might otherwise create uncertainty as to what capacity should be taken into account. Thus, under the final regulations, the term ''pre-uprate capacity'' means the nameplate capacity or specified capacity of an electricity generating facility before an uprate, and the term ''post-uprate capacity'' means the nameplate capacity or specified capacity of an electricity generating facility after an uprate.

Some comments stated that an EAC should satisfy the incrementality requirement if it is produced from an electricity generation facility that has shut down and then restarted. Several of these comments gave the specific example of decommissioned and restarted nuclear facilities. In response to this, the Treasury Department and the IRS note that, unless the restarted electricity generation facility has a new COD, the incrementality requirement would generally not be satisfied, as the electricity generation facility that produced the unit of electricity to which the EAC relates would have a COD more than 36 months before the hydrogen production facility for which the EAC is retired was placed in service. However, the Treasury Department and the IRS agree with comments asserting that the electricity generated from a restarted facility should be considered incremental production. To provide for this, the final regulations add § 1.45V–4(d)(3)(i)(B)(*2*), which clarifies that a facility that is decommissioned or in the process of decommissioning and restarts can be considered to have increased nameplate or specified capacity from a base of zero if the existing facility has ceased operations. Additionally, the facility must have a shutdown period of at least one calendar year during which it was not authorized to operate by its respective Federal regulatory authority (either the FERC or the NRC), and the increased capacity of the restarted facility must be eligible to restart based on an operating license issued by the regulatory authority. The existing facility must also not have ceased operations for the purpose of qualifying for the special rule for restarted facilities. This special rule for restarted facilities relies, in part, on operating authorizations provided by governmental or quasi-governmental agencies to provide an administrable and verifiable means of distinguishing a restart that should be treated like an addition of incremental electricity-generating capacity from temporary cessations or interruptions in an electricity-generating facility's operations.

Finally, the Treasury Department and the IRS remind taxpayers that a qualified hydrogen production facility is only able to claim incremental production associated with an uprate if the relevant EAC registry tracks it via EACs. The Treasury Department and the IRS expect that EAC registries will identify a proportional amount of EACs generated in every month—or, beginning in 2030—every hour as ''incremental'' for purposes of 45V, based on the proportional increase in capacity due to the uprate.

iv. Qualifying States

In the Explanation of Provisions to the proposed regulations, the Treasury Department and the IRS noted that, in certain circumstances, the diversion of existing minimal (that is, zero or near-zero) emissions power generation to hydrogen production may be unlikely to result in significant induced GHG emissions and noted as one such circumstance the generation from minimal-emitting power plants in locations where grid-electricity is 100 percent generated by minimal-emitting generators or where increases in load do not increase grid emissions, for

example, due to State policy capping total GHG emissions.

The Treasury Department and the IRS received numerous comments in support of a rule that accounts for such circumstances. In response to comments and after consultation with the DOE and the EPA, the final regulations provide an alternative pathway for establishing incrementality, under which an EAC meets the incrementality requirement if the electricity represented by the EAC is produced by an electricity generating facility that is physically located in a qualifying state (as defined in § 1.45V–4(d)(2)(xii)), and the hydrogen production facility is also located in a qualifying state.[27] The final regulations define qualifying State as a State which, as determined by the Secretary, has under its State law or regulations, a qualifying electricity decarbonization standard and a qualifying GHG cap program.

A qualifying electricity decarbonization standard is defined as a standard that (i) contains a target that 100 percent of the State's retail sales of electricity from obligated entities be supplied by renewable, non-emitting, zero-emitting, or minimal-emitting sources, where obligated entities and eligible sources are defined by State policy, or a target for GHG emissions from the State's electricity sector that reflects an equivalent of such a retail sales target, by 2050 or earlier; (ii) applies to the large majority of eligible electricity supplied to the State, as determined by the State; and (iii) includes policies that would achieve that target, a requirement that the State develop a plan to achieve the standard, or a requirement that entities subject to the standard are required to develop such a plan. A State RPS or CES that meets these requirements would be a qualifying electricity decarbonization standard.

A qualifying GHG cap program is defined as a legally binding program that (i) creates a limitation (cap) on the quantity of GHG emissions from the electricity sector (either alone or along with other sectors) in the State through issuance of a limited number of allowances or other compliance instruments to covered entities for each compliance period; (ii) includes annual obligations under which an entity subject to the cap must provide information about such entity's GHG emissions and for which an entity must submit at least some compliance instruments to the State's regulatory authority; (iii) includes a cap on GHG emissions from covered entities that generally declines over time from the cap on GHG emissions in effect in calendar year 2025 (or the first calendar year in which the cap is in effect, if later), with adjustments as appropriate for expansions in the scope of the cap; (iv) applies to the large majority of in-state power-sector sources of emissions that emit greater than 25,000 metric tons of CO2e in a calendar year; (v) applies to the large majority of out-of-state electricity supplied to the State and to emissions associated with those imports, including emissions that arise from entities that emit greater than 25,000 metric tons of CO2e in a calendar year; (vi) generally ensures that the prices of allowances sold in a state-run auction cannot fall below $25 per metric ton of CO2e, adjusted for inflation from 2025 dollars using at a minimum the most recently available twelve month value of the Consumer Price Index for All Urban Consumers (CPI–U), as published by the United States Bureau of Labor Statistics (BLS); and (vii) generally ensures that the cap on GHG emissions cannot be exceeded for less than $90 per metric ton of CO2e, adjusted for inflation from 2025 dollars using at a minimum the most recently available twelve-month value of the CPI–U, as published by the BLS.

The definition of qualifying State provides conditions under which State law is sufficiently effective and stringent to conclude with a reasonable degree of certainty that new load is highly unlikely to cause induced grid emissions. As further described in this part III.D.3.b.iv, a robust, legally binding State GHG emissions cap that satisfies the qualifying GHG cap requirements is the primary criterion, because it ensures that overall GHG emissions are effectively capped regardless of electricity demand growth. The qualifying electricity decarbonization standard provides a further protection to ensure that significant induced power grid emissions are avoided, even in the context of a multi-sector GHG emissions cap, by requiring a State to also maintain a statutory commitment to decarbonize its own power supply, such as a CES or RPS.

Hydrogen production facilities located in qualifying States can therefore satisfy the incrementality requirement by using qualifying EACs from existing clean electricity sources located in qualifying States. Temporal matching and deliverability requirements will continue to apply for qualified EACs, as will the need to retire those EACs to ensure EACs and their energy and emissions attributes are not double counted or claimed by other electricity consumers.

The requirement that a qualifying State have a qualifying GHG cap program and qualifying electricity decarbonization standard, and the requirements for such program and standard, are meant to identify circumstances under which new electricity load is highly unlikely to cause induced grid emissions. In consultation with the DOE, the Secretary has determined that, as of the date of publication of these final regulations, California and Washington are qualifying States under these final regulations. The requirements in these regulations to be a qualifying GHG cap program and meet the qualifying electricity decarbonization standard are based in part on those programs, which the DOE has advised have functioned in practice as robust caps.

With respect to the definition of a qualifying GHG cap program, the Treasury Department and the IRS note that whether a State GHG cap is binding is influenced by many features, including but not limited to, the magnitude of the emissions cap relative to historical and projected emissions; definitions of and use limitations regarding carbon offsets; and the status of and procedures governing the withholding of and release of allowance reserves. As a check on the combined effect of these features on the stringency of the GHG policy and to ensure that they are not undermining the cap to the point where it is not sufficiently ensuring that new electricity load, such as from hydrogen production, will not result in induced grid emissions, requirements for a qualifying GHG cap program generally ensures a minimum allowance price set through statute or regulation. To determine the appropriate allowance price, the Treasury Department and the IRS, in consultation with the DOE, took into consideration observed allowance prices over the past several years in the existing State systems that the DOE has advised were robust over that period. Upon conclusion of that exercise, the minimum required allowance price of $25 per metric ton in 2025, and increasing with inflation each year after 2025, was determined to be high enough such that a GHG cap policy provides sufficient incentive to reduce emissions beyond what might occur without the program. In other words, the level is high enough to ensure the cap provides a meaningful constraint on emissions.

The Treasury Department and the IRS are aware that GHG cap systems are often designed with ceiling prices, such as, for example, an alternative

[27] Because this is an alternative pathway only to the incrementality requirement, the deliverability and temporal matching requirements still apply.

compliance pathway wherein obligated entities are allowed emissions in excess of the stated GHG cap in the event that allowance prices reach the ceiling. If diversion of existing clean electricity to hydrogen production caused the ceiling price to be reached, that would effectively cause emissions to exceed the cap. Therefore, if a State system has a ceiling price set through statute or regulation, requiring that ceiling price to be set well above the maximum allowance price observed in existing systems is necessary to help ensure that a State is, in practice, unlikely to reach the ceiling price as a result of increased electricity demand for hydrogen production. These final regulations require this ceiling price to be established by statute or regulation at $90 per metric ton of CO2e or more in 2025, increasing with inflation each year after 2025. This level is more than two times higher than the average prices observed over the last several years in the two existing State systems the DOE advises were robust over that period.

Collectively, these requirements help ensure that, in the context of this alternative incrementality pathway, any increased electricity load is highly unlikely to cause induced grid emissions. With the requirements specified here, qualified GHG cap policies will be enforceable by legal means, feature emissions targets and carbon allowance prices that provide a sufficient incentive to reduce emissions to meet those targets and achieve emissions reductions beyond what might occur without the program, enable carbon allowance prices to rise to ensure the cap is maintained, and minimize the risk of emissions leakage to other geographies and entities not obligated to comply with the program.

The Treasury Department and the IRS note that a robust but a multi-sectoral GHG cap program alone cannot, with sufficient certainty, ensure that induced grid emissions in States with such a program are insignificant. A multi-sectoral cap may allow emissions to rise in the power sector as a result of induced demand from hydrogen production while offsetting those emissions increases with reductions in other sectors.

There are several reasons the Treasury Department, the IRS, the DOE, and the EPA have confidence that the risk of induced grid emissions will be limited in States with a qualifying GHG cap, as required by these final regulations. First, in the State with the longest experience with a robust multi-sector GHG cap, California, the electricity sector has been a leading source of emissions reductions over the last decade.[28] Second, numerous studies have shown that in the context of effective GHG emission policies, the electricity sector is likely to remain a leading sector for decarbonization, in part given the availability of multiple low-cost clean electricity technologies.[29] Third, as a result, it is unlikely in practice that a State could remain in compliance with its cap while experiencing a significant absolute increase in grid emissions due to new hydrogen production. Finally, as noted, States are also required to meet certain minimum requirements for an electricity decarbonization standard, providing additional assurance that the State is committed to ongoing reductions in power sector emissions.

With respect to the qualifying electricity decarbonization standard, some comments suggested that a CES or RPS requirement, on its own, should be sufficient to ensure incrementality. However, a clean electricity target, absent a legally binding emissions cap, does not protect against induced grid emissions and ensure a lifecycle GHG emissions rate that is eligible for the section 45V credit; a State with such a target could still experience a significant increase in GHG emissions due to diverted grid electricity from out-of-state or increased electricity demand for hydrogen production, with no reliable mechanism to prevent these increases. Critically, unless a State policy requires 100 percent clean electricity in any year, including from imports, even a legally binding decarbonization standard would permit diverted clean electricity to be partially replaced with non-clean sources, increasing grid emissions that would need to be captured in the facility's lifecycle GHG emissions rate. Currently, no State has adopted a policy that requires 100 percent clean electricity in 2024 or 2025.

Hydrogen production facilities located in qualifying States can satisfy the incrementality requirement by using qualifying EACs from existing clean electricity generators located in those same or other qualifying States. Some comments requesting an exception based on State policies on qualifying GHG emissions caps and qualifying electricity decarbonization standards recommended expanding the exception to include all three qualifying EAC requirements. These final regulations do not adopt a broader rule, instead limiting the rule as an alternative way to satisfy the incrementality requirement only. The qualifying States pathway provides reasonable assurance that any existing clean electricity generation that is diverted from another end use will not result in an increase in grid emissions and will instead be replaced by more clean electricity. Notably, the fact that meeting these requirements adequately addresses the incrementality requirement does not obviate the temporal matching or geographic matching requirements, which must also be met to provide assurances that the electricity was available and deliverable to the hydrogen producer. Therefore, temporal matching and deliverability requirements will continue to apply, and producers will need to obtain and retire qualifying EACs to demonstrate that they meet these requirements and to thereby avoid the possible double crediting of energy and emissions attributes.

v. Qualifying Nuclear Reactors

In the Explanation of Provisions to the proposed regulations, the Treasury Department and the IRS sought comments on whether to treat EACs from an existing electricity generating facility as satisfying the incrementality requirement if the facility is likely to mitigate its risk of retirement because of its relationship with a hydrogen production facility. The Treasury Department and the IRS also noted that the available data indicates there is an ongoing risk of certain clean power plants retiring. Some clean power plants, primarily nuclear plants, have retired in recent years. Based on data from the EIA, from 2013 through 2022, 10,800 megawatts (MW) of nuclear have retired.[30] Studies have shown that there is risk of continued retirement in the

[28] California Air Resources Board, *California Greenhouse Gas Emissions from 2000 to 2022: Trends of Emissions and Other Indicators* (Sept. 20, 2024), available at *https://ww2.arb.ca.gov/sites/default/files/2024-09/nc-2000_2022_ghg_inventory_trends.pdf.*

[29] *See* Morgan Browning, et al., *Net-Zero CO_2 by 2050 Scenarios for the United States in the Energy Modeling Forum 37 Study,* 4 Energy and Climate Change, Dec. 2023; John Bistline et al., *Emissions and Energy Impacts of the Inflation Reduction Act,* 380 Science, no. 6652, Jun. 29, 2023, at 1324–27; James Williams, et al., *Carbon-Neutral Pathways for the United States,* 2 AGU Advances, no. 1, Mar. 2021, available at *https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2020AV000284;* James R. McFarland, et al., *Overview of the EMF 32 Study on U.S. Carbon Tax Scenarios,* 9 Climate Change Economics, no. 1, Feb. 2018, available at *https://www.worldscientific.com/doi/epdf/10.1142/S201000781840002X;* Leon E. Clarke, et al., *Technology and U.S. Emissions Reductions Goals: Results of the EMF 24 Modeling Exercise,* 35 The Energy Journal, no. 1, Jun. 2014.

[30] *Preliminary Monthly Electric Generator Inventory (based on Form EIA–860M as a Supplement to Form EIA–860),* U.S. Energy Information Administration, available at *https://www.eia.gov/electricity/data/eia860m/.*

years ahead.[31] Plant owners may decide whether to retire based on the finances of continuing to operate. Additional revenue from selling EACs and electricity to hydrogen producers may improve the financial outlook of some plants enough to help avert retirement, thereby keeping the plant in operation and substantially reducing induced grid emissions compared to a scenario in which the plant retires.

Several comments urged the Treasury Department and the IRS to consider an exception to the qualifying EAC requirements for hydrogen production facilities using electricity from existing nuclear facilities. After considering these comments, the final regulations adopt a rule under which an EAC may meet the incrementality requirement if the electricity represented by the EAC is produced by an electricity generating facility that is a qualifying nuclear reactor, as defined in § 1.45V–4(d)(2)(x). For purposes of this rule, only up to 200 megawatt hours (MWh) of electricity per operating hour per qualifying nuclear reactor may be considered incremental, subject to an integrated operations rule described in this part III.D.3.b.v of the Summary of Comments and Explanation of Revisions.

The term qualifying nuclear reactor is defined as, with respect to an EAC, a nuclear reactor that: (i) is a merchant nuclear reactor, as defined in § 1.45V–4(d)(2)(vi), or is a nuclear reactor that is not co-located with any other operating nuclear reactor (that is, the nuclear reactor is a single unit plant); (ii) meets a financial test related to that used for purposes of the section 45U credit for any two of the calendar years 2017 through 2021, as determined with respect to any one owner of the reactor; and (iii) either (A) has a behind-the-meter physical electric connection with the hydrogen production facility that acquires and retires the EAC or (B) is the subject of a written binding contract, for a fixed term of at least 10 years beginning on the first date on which qualified EAC are acquired, under which the owner of the hydrogen production facility agrees to acquire and retire EACs from the nuclear reactor, and which manages the qualifying nuclear reactor's risk of price changes with respect to EACs or electricity. ''Merchant nuclear reactors'' are nuclear reactors that compete in a competitive electricity market through the sale of energy and, in some cases, other services, and for which over 50 percent of the reactor and its electricity production does not receive cost recovery through rate regulation or public ownership with related retail rate recovery. However, as provided in § 1.45V–4(d)(3)(i)(D)(*5*), to the extent the nuclear reactor satisfies the definition of a qualifying nuclear reactor because it is the subject of a written binding contract as provided in paragraph § 1.45V–4(d)(2)(x)(C)(*2*), only the megawatt hours of electricity for which the taxpayer acquires EACs from the nuclear reactor pursuant to the written binding contract—subject to the 200 MWh per hour per qualifying nuclear reactor limit—may be considered incremental.

The Treasury Department and the IRS note that, among existing clean electricity generating facilities, nuclear plants have the most demonstrably significant risk of retirement based on historical trends and future projections. Nuclear generators are also the largest sources of clean electricity on an individual reactor basis, and therefore closure of any reactor represents significant potential emissions increases. While the total capacity of operational nuclear power has declined in the past decade, the capacity of most other clean energy sources has increased. Future retirement risk is also concentrated on nuclear power plants.[32]

The requirements defining a qualifying nuclear reactor identify those plants that are most at risk of retirement. First, the rule limits qualifying nuclear reactors to nuclear reactors that bear substantial wholesale electricity market price risk through merchant power sales, rather than cost-of-service (COS)-based guaranteed revenue, and to single-unit COS plants. Not all nuclear plants are at equal risk of retirement; plants with greatest risk are those with lower or more uncertain revenue and/or with higher operational costs, namely merchant plants and single-unit plants. Merchant plants are exposed to volatile and sometimes low wholesale market prices. Although such plants may have some power purchase agreements (PPAs) and hedges, those tend to be limited, and such plants are very exposed to changes in wholesale power markets. By contrast, COS plants are less exposed, as their ability to remain economic depends on periodic rate-cases and resultant cost-based rates. Competitive pressures remain but are mediated with more long-term planning considerations by plant owners as well as regulators and other stakeholders. Based on responses collected through its Form EIA–860, *Annual Electric Generator Report,* EIA reports the ''Regulatory Status'' of power plants in its Form EIA–860 data. Following consultation with the DOE, the Treasury Department and the IRS understand that those nuclear reactors that are part of nuclear power plants listed as ''NR'' (non-regulated) in the 2023 Final Form EIA–860 data are generally likely to meet the merchant plant definition in these final regulations.

Single-unit COS plants are also at risk because they tend to have higher operating costs per MWh of production than multi-unit plants.[33] The DOE has also surveyed past retirement patterns to identify the plant characteristics associated with the highest retirement rates, and its findings are consistent with the above proposed restrictions.

As part of identifying nuclear reactors most at risk of retirement, these final regulations provide a financial test. A nuclear reactor meets the financial test if the average annual gross receipts (as defined under section 45U) of the reactor were less than 4.375 cents per kilowatt hour for any two of the calendar years from 2017 through 2021. This financial test reflects the framework adopted by Congress in the IRA in section 45U, which provides support for existing nuclear plants during periods in which their receipts are below a threshold level. The Treasury Department and the IRS anticipate releasing guidance under section 45U in the future, including on the definition of gross receipts. Rules under such guidance for calculating gross receipts would also apply for purposes of the financial test provided in § 1.45V–4(d)(2)(x)(B). The threshold of 4.375 cents is the gross receipts amount per kilowatt hour at which the section 45U credit falls to zero in its first year. Calendar years 2017 through 2021 were chosen to make the test a retrospective one, spanning the five calendar years prior to the year of enactment of the IRA, allowing the financial test to serve as one of multiple indicators of retirement risk while enabling owners of nuclear reactors to

[31] *See* John Bistline et al., *Emissions and Energy Impacts of the Inflation Reduction Act,* 380 Science, no. 6652, Jun. 29, 2023, at 1324–27; *Annual Energy Outlook 2023,* U.S. Energy Information Administration, available at *https://www.eia.gov/outlooks/aeo/tables_ref.php* (last updated Mar. 16, 2023).

[32] For example, a 2023 article in the journal Science highlights findings across nine different models, showing uncertainty but significant nuclear retirement risk across many assessments over the longer term. *See* John Bistline et al., *Emissions and Energy Impacts of the Inflation Reduction Act,* 380 Science, no. 6652, Jun. 29, 2023, at 1324–27.

[33] For example, the Nuclear Energy Institute has estimated that single-unit plants' costs averaged $41/MWh in 2022, whereas multi-unit plants' costs average $29/MWh. *See* Nuclear Energy Institute, *Nuclear Costs in Context* (Dec. 2023), available at *https://www.nei.org/CorporateSite/media/filefolder/resources/reports-and-briefs/2023-Costs-in-Context_r1.pdf.*

determine in advance whether their reactors meet it. If a single nuclear reactor has multiple owners, any co-owner of the reactor may qualify the reactor for the financial test. This would provide a simplified calculation that does not require averaging across different owners that may have different gross receipts calculations. Although the co-owner used to satisfy the financial test does not have to be the same co-owner from whom the hydrogen producer acquires the relevant EACs and electricity generated by the reactor, the same co-owner must be used for both of the two relevant years from 2017 to 2021 to satisfy the financial test with respect to the reactor.

The rule includes two alternatives for demonstrating that the hydrogen production facility is materially contributing to the continued operation of the at-risk nuclear reactor over the long term. Under the first approach, a physical, behind-the-meter, connection and investment between hydrogen production facility and plant demonstrates a long-term commitment to operation of both, thereby enabling the hydrogen producer to reduce the risk of retirement for the nuclear reactor. The DOE has advised that hydrogen production facilities are capital-intensive, long-lived assets, so that a behind-the-meter arrangement of this type is expected to reduce retirement risk. Under the second approach, the long-term commitment is demonstrated by a written binding contract between the owner of the hydrogen production facility and the owner of the nuclear reactor, under which the owner of the hydrogen production facility agrees to acquire and retire EACs from the nuclear reactor. The written binding contract must be for at least 10 years beginning on the first date on which qualified EAC are acquired and in effect during the time the EACs for which the incrementality requirement is being satisfied is being acquired. Further, only the megawatt hours of electricity for which the taxpayer acquires EACs from the nuclear reactor pursuant to the written binding contract may be considered incremental.

The contract must also provide a means of managing the qualifying nuclear reactor's revenue risk. This could be satisfied by either a PPA or virtual PPA with respect to the electricity generated by the nuclear reactor, or by another provision in the contract that fixes the price of the electricity or allows the price of EACs to vary in a manner that hedges the seller's exposure to market price risk. EAC sales that lack a long-term binding contract do not reflect the same long-term investment and planning, so would not qualify for this allowance.

For purposes of the written binding contract definition under § 1.45V–4(d)(2)(xi), a contract is a ''binding contract'' if it is enforceable under State law against the taxpayer or a predecessor and does not limit damages to a specified amount (for example, by use of a liquidated damages provision). For this purpose, a contractual provision that limits damages to an amount equal to at least five percent of the total contract price will not be treated as limiting damages to a specified amount. For additional guidance regarding the definition of a written binding contract, see § 1.168(k)–2(b)(5)(iii). In addition, in the case of a nuclear reactor that satisfies the definition of a qualifying nuclear reactor because it is the subject of a written binding contract, the MWh of electricity per hour per qualifying nuclear reactor that may be considered incremental are further limited to those megawatt hours of electricity for which the taxpayer acquires EACs from the nuclear reactor pursuant to the written binding contract.

Finally, the final regulations cap the amount of electricity that is deemed incremental at 200 MWh per operating hour per nuclear reactor. See § 1.45V–4(d)(3)(i)(D)(*2*). The Treasury Department and the IRS note that reducing retirement risk does not require the electrolyzer to be sized at the full capacity of the co-located nuclear plant, and sizing at full capacity significantly increases the risk of induced grid emissions. A hydrogen producer's purchases of electricity beyond the amounts needed to substantially reduce the retirement risk of the nuclear reactor would divert that electricity from other uses on the grid, requiring additional electricity generation with the substantial risk that it will be generated by emitting sources. A 200 MWh per operating hour per nuclear reactor limit is consistent with the size of commercial scale electrolyzers, the deployment of which would demonstrate a significant long-term commitment, investment, and revenue stream, reducing the risk of the nuclear plant's retirement. In contrast, as advised by the DOE, a hydrogen producer's additional purchases of electricity beyond these amounts would not meaningfully provide for an additional reduction in the retirement risk of the nuclear reactor. Therefore, permitting the diversion of this electricity from other uses is likely to increase emissions.

The 200 MWh per operating hour per reactor limit is subject to an integrated operations rule, which offers additional flexibility by providing an aggregate limit of 200 MWh per hour multiplied by the number of integrated nuclear reactors that have not permanently ceased operations. For example, two qualifying nuclear reactors treated as having integrated operations with each other would have an aggregate 400 MWh per operating hour that may be considered incremental, which can be allocated across both reactors. A qualifying nuclear reactor is treated as having ''integrated operations'' with any other qualifying nuclear reactor if the reactors are: (i) owned by the same or related taxpayers and (ii) transmit electricity generated by the reactors through the same point of interconnection or, if the reactors are not grid-connected, or are delivering electricity directly to an end user behind a utility meter, are able to support the same end user, or, if the reactors have multiple points of interconnection, are co-located with each another. The term *related taxpayers* means members of a group of trades or businesses that are under common control (as defined in § 1.52–1(b)). Related taxpayers are treated as one taxpayer in determining whether a qualifying nuclear reactor has integrated operations.

Applying the 200 MWh per operating hour limit at the reactor level (rather than the plant level) is appropriate because project owners can vary across reactors at multi-reactor plants; so too can revenues and costs and therefore retirement decisions. Historically, there have been instances when a single reactor at a multi-reactor site has retired, indicating that decisions of whether to retire individual reactors could be made independent of other reactors in a facility. The Treasury Department and the IRS note that EAC registries would need to develop methods to identify incremental EACs consistent with the cap of 200 MWh of electricity per operating hour per nuclear reactor.

Some comments supported allowing the entire capacity of any nuclear power plant that undergoes relicensing to qualify as incremental, with no other limitations on co-location or other qualifying criteria. These comments characterized the decision to undergo relicensing as a significant business decision that often requires significant capital and operational expenditures. Some comments suggest that both nuclear and hydropower plants should qualify on this basis. In response to these comments, the Treasury Department and the IRS note that, unlike the criteria for qualified nuclear plants provided in these final

regulations, a rule that were to treat the full capacity of any nuclear plant that undergoes relicensing as incremental would not be reasonably tailored to identify reactors with high retirement risk or to circumstances in which a hydrogen producer will meaningfully forestall retirement. It would fail to account for the likelihood that facilities in strong financial condition are just as, if not more, likely to seek relicensing as those at financial risk because, as the DOE has advised, nuclear plants have been consistently relicensed when they reach the end of a licensing period. Whether a plant is relicensed is primarily a function of the plant's age, not its retirement risk. While relicensing an older plant involves a significant business decision, and continued operation of a nuclear plant after relicensing will often require additional capital and operational expense, these expenses, alone, do not demonstrate that the plant is at risk of retirement. Such costs would be required and expended for facilities that are at little risk of retirement for economic reasons, such as those whose gross revenues from customers other than hydrogen producers significantly exceed these costs, or those who can rely on cost-of-service rate recovery. The DOE has further advised that past retirement decisions for nuclear reactors have often been tied to unfavorable economic conditions, but have not obviously been triggered by license renewal timelines. Many historic retirements have occurred after a plant sought, and in many cases received, a license renewal. This evidence further shows that relicensing is related to plant age but is not a strong indicator of retirement risk. Including all nuclear facilities that undergo relicensing under this rule, despite the fact that not all such plants are at significant risk of retirement and many would continue serving existing non-hydrogen customers after relicensing, would incorrectly result in a large amount of energy to be deemed incremental. Such a scenario presents a high risk of significant unaccounted for induced grid emissions, and so would be inconsistent with statutory requirements. Comments addressing hydropower electricity are addressed in part III.D.3.b.vi of this Summary of Comments and Explanation of Revisions.

In response to comments, the Treasury Department and the IRS also considered whether to add relicensing as an additional requirement of the qualifying nuclear facility rule. However, adding such a requirement could unduly limit the ability of plants that have recently been relicensed or whose relicensing date is many years in the future, but that are nonetheless at risk of retirement and for which hydrogen production could significantly reduce that risk, from benefiting from the rule. These final regulations, therefore, do not adopt criteria related to nuclear plant relicensing recommended by comments.

vi. Other Proposed Alternatives

The Treasury Department and the IRS received comments suggesting other, incrementality pathways. One comment recommended the use of locational marginal prices as a proxy for incrementality and temporal matching under certain price conditions. Locational marginal prices are not available on a nationwide basis and vary considerably from one year to the next—and even one hour to the next. Use of locational marginal prices would not provide a comprehensive or consistent measure for incrementality, and it is unclear how hydrogen production facilities could use such a proxy.

In the Explanation of Provisions to the proposed regulations, the Treasury Department and the IRS sought specific comment with respect to formulaic approaches to incrementality. As described therein, one such approach deems five percent of the hourly generation from minimal-emitting electricity generators (for example, wind, solar, nuclear, and hydropower facilities) placed in service before January 1, 2023, as satisfying the incrementality requirement. The Treasury Department and the IRS noted that this pathway may be appropriate because some circumstances during which incremental generation would be unlikely to result in significant indirect grid emissions (including periods of curtailment or times when generation from minimal-emitting electricity generation is on the margin) may be difficult to anticipate or identify, or because the process for identifying the circumstances (such as avoided retirement risk or modeling of minimal emissions) may be overly burdensome to evaluate for specific electricity generators or require data that is not available.

In response to this, several comments recommended that the final regulations adopt an alternative incrementality pathway based on a proxy for curtailment. As one comment explained, if both demand and clean supply are in the same transmission region or pocket during a period when the marginal producer is a clean energy resource (such as during periods of curtailment), then incremental power demand for clean hydrogen production is met by existing clean electricity generators without increasing overall grid emissions. Following consultation with the DOE and the EPA, these final regulations do not adopt such an approach at this time, as identifying specific cases where incremental power demand is met with existing clean electricity would require determining the marginal source of electricity production for each time period and region, the data for which does not currently exist nationally. However, the Treasury Department and the IRS will continue to study the issue, in consultation with the DOE and the EPA.

Other comments expressed support for a formulaic approach that deemed a certain percent of the hourly generation from minimal-emitting electricity generators as satisfying the incrementality requirement. Some expressed support for a five-percent threshold, while others suggested that the threshold should be ten percent or higher. Others disagreed with a specific percentage and suggested instead that a deemed amount of incrementality be determined based on market factors or average curtailment. Comments in support of a formulaic approach justified the approach as an appropriate proxy for curtailment, retirement risk, or other cases where additional use is likely to be met with clean electricity. On the other hand, many comments opposed a formulaic approach, asserting that it is an inadequate proxy for incrementality and would lead to induced grid emissions. Comments provided estimates indicating that the large majority of the generation exempt from incrementality requirements under a formulaic approach would not be generated during periods of curtailment and would be expected to result in induced emissions, even under an approach where proxy amounts varied based on regional curtailment rates. Comments also provided estimates of the impact of a five-percent formulaic proxy on induced emissions, contending that the result of this approach would be to provide the section 45V credit to substantial generation for which actual emissions exceeded statutory thresholds. In consideration of these comments and in consultation with the EPA, the Treasury Department and the IRS agree with those comments that oppose the formulaic approach for the reason that it is an inadequate proxy. The Treasury Department and the IRS understand that curtailment is very region and time dependent, and the precise timing of curtailment is hard to predict. A broad-

based formulaic approach would not likely align in time or geography with generation that would otherwise have been curtailed, which happens in temporally and geographically concentrated windows. These factors make the formulaic approach inadequate in mitigating induced grid emissions, while an approach that is based on real-time market factors would be difficult to administer and use. As a result, most generation exempt from incrementality requirements under the formulaic approach would be expected to result in significant indirect emissions. Therefore, the formulaic approach is in conflict with the statutory requirements regarding lifecycle GHG emissions. In contrast, these final regulations contain two additional alternative pathways, the qualifying States pathway and the qualifying nuclear reactor pathway, that are better tailored to circumstances in which the use of existing clean generation to produce hydrogen is unlikely to result in induced grid emissions. The addition of these more specific, alternative incrementality pathways casts further doubt on the need for and appropriateness of a percentage-based proxy that is not tailored to any specific conditions or circumstances that relate to the likelihood of induced grid emissions.

Finally, several comments noted the prevalence and importance of hydropower as a clean electricity source in certain parts of the country and advocated for an across-the-board exception to the incrementality requirement for electricity derived from clean hydropower. Other comments, noting the long time period for the permitting and construction of a hydropower facility, stated that the 36-month lookback period is too short. On the other hand, one comment noted the possibility that the section 45V credit could incentivize hydropower projects that are societally and ecologically detrimental and advocated that an additional requirement be placed on such projects, requiring them to obtain low-impact certification using science-based criteria. In response, these final regulations do not adopt a rule exempting hydropower from the incrementality requirement, as such a rule would fail to take into account significant indirect emissions, as required by section 45V(c)(1)(A) and section 211(o)(1)(H) of the Clean Air Act. In addition, the DOE has advised that the risk of retirement for hydropower is comparatively lower than the risk of retirement for nuclear power. Finally, certain hydropower plants may be able to utilize the qualifying State pathway or the uprates pathway to satisfy the incrementality requirement. These regulations also do not impose an additional requirement on hydropower, such as a low-impact certification requirement, as this is not required by the statute and would disadvantage incremental hydropower relative to other incremental sources of clean energy.

c. Temporal Matching

Proposed § 1.45V–4(d)(3)(ii) would provide that an EAC meets the temporal matching requirement if the electricity represented by the EAC is generated in the same hour that the taxpayer's hydrogen production facility uses electricity to produce hydrogen. It also would provide a transition rule for EACs representing electricity generated before January 1, 2028, stating that an EAC meets the temporal matching requirement if the electricity represented by the EAC is generated in the same calendar year that the taxpayer's hydrogen production facility uses electricity to produce hydrogen.

i. Hourly Matching

Many comments expressed support for the proposed temporal matching rule, referred to as ''hourly matching.'' One comment noted that requiring hourly matching will lead EAC registries to quickly create hourly tracking mechanisms. Several comments suggested that delaying the implementation of hourly matching until 2028 was unnecessary, offering a variety of suggestions to move up the timeline.

Other comments opposed the hourly matching rule for various reasons. Some comments opposed hourly matching because it does not account for the variability of wind and solar, which are prevalent sources of clean energy. Some comments noted that hourly matching leads to increased capital costs that decrease the viability of electricity-intensive hydrogen production. One comment expressed concern that hourly matching increases costs more than the credit will reduce them. One comment noted that the increased costs would push the industry to shift to lower cost solutions, like purchasing foreign equipment that may be less expensive than higher cost domestic equipment. Another comment noted that these higher costs will specifically hinder investment in smaller regional facilities. Several comments expressed concern about the hourly matching rule as applied to the Regional Clean Hydrogen Hubs because hourly EAC requirements were not contemplated by hydrogen hub participants at the time they applied for funding from the DOE to be a hydrogen hub participant or because the requirement does not align with anticipated construction schedules. One comment contended that hourly matching is too difficult to administer because of poor infrastructure, software limitations, and regulatory hurdles.

Several comments recommended alternative periods for matching, such as daily, monthly, quarterly, or annual. Comments advocating for monthly matching suggested that monthly matching would be more beneficial than hourly matching for electrolytic hydrogen producers because it would likely decrease the operational impact on electrolyzers by reducing the number of stoppages, which can lower costs and prolong the durability of the equipment. Other comments recommended monthly matching as a reasonable compromise between annual and hourly matching. One comment stated that the required timeline for matching should align with the battery electric vehicle standards. One comment maintained that hourly matching is unworkable based on current tracking practices.

Temporal matching at an hourly level best mitigates the risk of induced grid emissions by requiring that the generation that created the EACs must occur at the same time as the EAC buyer's load. As noted in the DOE Technical Paper and studies cited by comments, the three qualifying EAC requirements address both operational (short-term) and structural (long-term) effects that can affect lifecycle emissions outcomes.[34]

The DOE Technical Paper noted that hourly matching is necessary to properly address induced grid emissions. Hourly matching of EACs will provide significantly greater certainty about mitigating the risk of induced grid emissions by ensuring actual alignment between load and generation. However, as noted in the preamble to the proposed regulations, the Treasury Department and the IRS acknowledge that hourly tracking of EACs is not yet widely available on a standardized basis. The DOE has advised the Treasury Department and

[34] *See* DOE Technical Paper *supra* note 20; *see also* Michael A. Giovanniello, et al., *The Influence of Additionality and Time-Matching Requirements on the Emissions from Grid-Connected Hydrogen Production,* 9 Nature Energy, Feb. 2024, at 197–207; Electric Power Research Institute, et al., *Impacts of IRA's 45V Clean Hydrogen Production Tax Credit* (2023), available at *https://www.epri.com/research/products/000000003002028407;* Evolved Energy Research, *45V Hydrogen Production Tax Credits: Three-Pillars Accounting Impact Analysis* (2023), available at *https://www.evolved.energy/post/45v-three-pillars-impact-analysis.*

the IRS that tracking systems and related contractual structures for hourly matching will take some time to develop to an appropriate level of maturity. Accordingly, a transition rule that allows annual matching remains appropriate. The transition rule is intended to provide time for the EAC market to develop the hourly tracking capability necessary to verify compliance with this requirement, and for associated hourly EAC markets to develop. The transition rule, and associated comments, are discussed in part III.D.3.c.ii of this Summary of Comments and Explanation of Revisions.

Several comments suggested the adoption of a provisional approach to hourly matching before hourly matching is integrated into EAC registries. One comment suggested that this proposed approach could use hourly generation and hydrogen production meter data merged with annual or monthly EACs to demonstrate hourly matching where hourly EACs are not available.

The Treasury Department and the IRS note that nothing in this final regulation prohibits hydrogen producers from voluntarily implementing hourly matching prior to the phase-in date for hourly matching. Hence, no specific guidance is required on the allowed use of a provisional hourly matching approach prior to the end of the transition period. Allowing the provisional approach after the transition to hourly matching would place additional administrative burden on hydrogen producers and third-party verifiers and would complicate IRS administration. Moreover, allowing the provisional approach after the transition date may diminish the incentive for EAC registries to develop full hourly EAC tracking capability. Given these considerations, these final regulations neither explicitly allow nor require the provisional approach.

Multiple comments suggested that the Treasury Department and the IRS should consider providing a degree of flexibility in meeting the hourly temporal requirement, such as through allowing a limited percentage of annual electricity supply to be exempt from hourly temporality requirements. As one example, a comment recommended flexibility with respect to temporal matching for hydrogen producers located in States where the production of certain renewable energy is highly seasonal. However, as previously described, hourly matching is necessary to properly address induced grid emissions and to ensure that a hydrogen producer can properly attribute its load to a specific electricity source. The DOE has advised that exceptions that would allow some fraction of EACs to not be matched hourly increase the risk of induced grid emissions that would undermine one of the purposes of section 45V. In addition, any such fractional exception would require detailed and granular regional analysis. Allowing such fractional exceptions is therefore inconsistent with the statutory requirements and is not readily administrable. These final regulations, therefore, do not provide for fractional exceptions.

Along with the transition rule, these final regulations allow electricity storage to be used to shift the temporal profile of clean electricity supply as described in part III.D.3.c.v of this Summary of Comments and Explanation of Revisions. The Treasury Department and the IRS anticipate that these allowances may partially alleviate concerns with hourly temporal matching.

One comment requested clarification regarding the applicability of the National Renewable Energy Laboratory's Regional Energy Deployment System (NREL-ReEDS), a capacity planning model, to tracking hourly matching. The comment was submitted by a stakeholder that belongs to multiple power regions and expressed a need to acquire capacity in the next few years. The comment indicated that NREL-ReEDS is a potentially helpful tool in this regard because it covers 134 balancing areas.

The DOE has advised that NREL-ReEDS would not be an applicable tool for the purposes of compliance with hourly matching requirements or for providing detailed hourly grid carbon-intensity estimates. Hourly matching systems and hourly grid carbon-intensity estimates require detailed data of real-life plant-level generation patterns, whereas NREL-ReEDS is a forward-looking simulation tool that does not fully capture actual operations. Furthermore, NREL-ReEDs does not have the temporal resolution to characterize detailed operating behaviors of individual units,[35] which would be required of an hourly matching system used for compliance with these final regulations.

ii. Transition Period

Comments expressed divergent views on the appropriate timing of the transition rule. Many comments supported the proposed rule to allow annual accounting until 2028 and did not want it extended. Some comments supported hourly matching sooner than 2028. Several comments noted that a transition date of January 1, 2028, would provide enough time for registries to test and scale hourly EAC tracking systems nationwide. These comments urged the Treasury Department and the IRS not to unnecessarily delay or extend the transition date. According to one comment, the implementation date of January 1, 2028, would align with EU member states that decide to transition to hourly matching by mid-2027. However, the rest of the EU is required to transition to hourly matching in 2030 without a reliance rule. According to this comment, such alignment would help ensure that clean hydrogen and hydrogen-derived products such as ammonia, steel, and fertilizer will be available in the European market without confused, disjointed, or weak claims of low-carbon status. One comment expressed support for the current length of the transition rule but has suggested that, if the Treasury Department and the IRS decide to extend the duration of the pre-transition period, it should not go beyond December 31, 2029, to match EU regulations. Some comments stated that the Treasury Department and the IRS could implement hourly matching at present, even if hourly EACs are not yet available, by allowing taxpayers to use hourly meter data and annual or monthly EACs. One comment further recommended that the Treasury Department and the IRS review tracking registries' progress in developing the needed software by 2026 or 2027 and, if necessary, delay the transition by one year at a time (rather than to preemptively assume systems will not be ready).

Many other comments asked for a more extended timeframe before hourly matching is required. Generally, most comments supported extending the pre-transition period several years beyond 2027. Some comments recommended that the pre-transition period align with the EU's implementation of hourly matching in 2030. Additionally, while some comments did not specify a preferred duration of the pre-transition period, they did emphasize that hourly matching should be implemented only after the hourly EAC market is fully developed and ready for use, in particular for the relevant geographic region. Some of these comments expressed concerns about EAC registry and market readiness as well as the possible cost and operational burdens

[35] National Renewable Energy Laboratory, *Regional Energy Deployment System (ReEDS) Model Documentation* (2021), available at *https://www.nrel.gov/docs/fy21osti/78195.pdf.*

for clean hydrogen producers. Separate from the precise timing of the transition, other comments suggested preconditions or triggers for the transition, for example, a future study assessing readiness before proceeding.

Some comments recommending extension of the pre-transition period suggested allowing annual matching to continue for a longer duration before requiring hourly matching. Other comments recommended introducing quarterly or monthly matching, or some combination of annual and hourly matching, during an extended pre-transition period. Some comments also recommended extending the pre-transition period beyond the current end date, but on a facility-by-facility basis.

Comments also expressed that the Treasury Department and the IRS have focused on the wrong metric—whether the technology and systems exist for tracking hourly EACs—for evaluating when hourly matching should be required. According to these comments, a better metric for evaluating whether to proceed with the implementation of hourly matching is whether there is a consistent need for and supply of electricity from renewable sources. Other comments argued that the phase-in of hourly matching is not feasible until the grid's infrastructure can support 24-hour clean energy production. These comments argued that while clean energy technologies continue to grow, the infrastructures are not developing fast enough to support hourly matching. One such comment suggested that if hourly matching is mandated, there should be a monthly netting of the hourly mismatch between the actual energy provided and the energy that was scheduled. This comment claimed that errors in clean energy scheduling would significantly harm hydrogen producers using hourly matching.

Balancing these various comments and concerns, and as advised by the DOE and the EPA, the final regulations extend the transition period by two additional years, to 2030. Annual matching will be required through 2029, and hourly matching will be required thereafter. This requirement will apply to all production of qualified clean hydrogen represented by EACs starting in 2030, regardless of when the facility was placed in service.

These additional two years are warranted to ensure tracking systems can achieve the necessary functionality for an hourly matching requirement, and to allow the market to develop for hourly-matched EACs. In a survey of nine existing tracking systems, two respondents indicated that their systems are tracking on an hourly basis, although software functionality remains limited.[36] Fully developing the functionality of these systems will take time, as will creating and developing the functionality of hourly tracking infrastructure in other regions of the country. Of the other tracking systems, assuming that challenges are overcome, four respondents indicated that their systems will be able to adopt hourly matching in less than two years. One respondent indicated that their system will take from three to five years, noting that the timeline could be closer to three years if there is full State agency buy-in, clear instructions are received from Federal or State agencies, and funding for stakeholder participation is made available. Two respondents declined to give a timeline for how long it would take for their systems to develop this functionality. In the same survey, the respondents identified several challenges to hourly tracking that will need to be overcome, including cost, regulatory approval, interactions with state policy, sufficient stakeholder engagement, data availability and management, and user confusion. Among the issues that require resolution as EAC tracking systems move to hourly resolution is the treatment of electricity storage,[37] which this final regulation will allow as a means of shifting the temporal profile of clean generation. Some comments expressed confidence in the rapid scaling of hourly EAC tracking, markets, and matching, and others were skeptical. The survey of EAC registries is particularly informative, and it indicates that the registries themselves are generally confident that they can achieve the required functionality comfortably within the transition period provided in these final regulations.

In response to concerns raised by comments that the 2028 transition timeline proposed in § 1.45V–4(d)(3)(ii)(B) offers relatively little flexibility should technological or institutional implementation issues or delays arise, these final regulations add an additional two years to the transition so as to provide more flexibility and high confidence that implementation deadlines will be met. With this additional time, EAC registries should have ample time to develop hourly tracking mechanisms, and associated trading markets and contractual mechanisms will have sufficient time to mature. Given this extension, it is not necessary to establish a future trigger-based approach wherein the timing of the transition would be based on a future study because such an approach would diminish the incentives to create hourly matching functionality, potentially further delaying the transition with the risk of induced grid emissions that would result in tax credit claims that are contrary to the statute.

iii. Reliance Rule

Many comments requested a reliance rule or legacy allowance wherein facilities that have met a certain milestone by a certain date would be permitted to continue to satisfy the temporal matching rule by using annually-matched, instead of hourly-matched, EACs, for hydrogen produced after December 31, 2027. Recommended milestones include (1) beginning of construction; (2) placed in service; or (3) commencement of commercial operations. While most comments recommended requiring that the milestone be reached before January 1, 2028, some comments recommended that the Treasury Department and the IRS consider using later milestone dates.

Additionally, there are differing views on the scope of the reliance rule. While many comments supported it for the entire duration of the 10-year credit period, one comment suggested that the rule should only apply to the first five years. Other comments suggested that the first 10 gigawatts of project capacity should be represented by annual EACs, and hourly EACs thereafter. Similarly, some comments suggested allowing annual EACs to be used after December 31, 2027, for either a percentage of hydrogen production or a percentage of the total electricity used to produce hydrogen. Finally, the comments included both individual recommendations and combinations of multiple recommendations.

The comments provided various rationales for a reliance rule. One comment said that a reliance rule would enable the U.S. to become the global leader in green hydrogen, create jobs and a domestic supply chain, and ensure a reduction in GHG emissions in the industrial sector long term. Several comments indicated that a reliance rule would alleviate investment uncertainty during the 10-year credit period for certain projects (for example, early movers). Similarly, another comment claimed that a reliance rule would create consistent, ratable, and lower-cost volumes of hydrogen production.

[36] Rachael Terada, Director, Technical Products, Center for Resource Solutions, *Readiness for Hourly: U.S. Renewable Energy Tracking Systems* (Jun. 15, 2023), available at *https://resource-solutions.org/wp-content/uploads/2023/06/Readiness-for-Hourly-U.S.-Renewable-Energy-Tracking-Systems.pdf*.

[37] *See* DOE Technical Paper *supra* note 20.

Another comment said that, without a reliance rule, taxpayers will have to use hourly EACs for financial projection purposes beginning in year one, even though hourly EACs are not necessary until 2028. Another comment indicated that there is great uncertainty whether the industry can rely on hourly EACs and noted that the change from annual EACs to hourly EACs is too aggressive. For example, one comment said that hourly EACs effectively will restrict the operation of electrolyzers to times when renewable generation sources are available, which could increase the levelized cost of hydrogen for initial projects.

Several comments specifically advocated against any reliance rule that would allow producers to avoid the phasing-in of hourly matching. Another comment recommended a temporary approach prior to the 2028 phase-in that would utilize annual/monthly EACs so tracking systems like M–RETS will have an easier time transitioning to hourly matching. According to the comment, this temporary approach would also act as a provisional pathway if hourly matching were not feasible by 2028. Finally, one comment supported requiring a simulation of hourly matching in the years prior to 2028, beginning in 2026, which would facilitate a smoother transition to hourly matching. This would be in addition to the annual matching of EACs to actual hydrogen production for the purpose of calculating the section 45V credit.

These final regulations do not adopt a reliance rule or legacy allowance whereby projects that reach a certain milestone prior to a certain date are allowed to maintain something more permissive than hourly matching for a specified period or for the duration of the credit period. The qualifying EAC requirements are essential to fulfill the statutory mandate in section 45V(c)(1)(A) and section 211(o)(1)(H) of the Clean Air Act to address significant indirect emissions, which includes induced grid emissions, in assessing lifecycle GHG emissions for purposes of section 45V. A reliance rule or legacy allowance would increase the risk of such significant indirect emissions that must, under the statute, be considered in assessing the lifecycle GHG emissions rate. It is imperative to apply each of the qualifying EAC requirements to qualifying clean hydrogen production as soon as practicable to implement the statutory requirements.

iv. Other Approaches

Several comments recommended broader changes, alternatives, or exceptions to the proposed hourly matching framework. One comment suggested that, in the case of distributed renewable energy that is not connected to the grid, the final regulations should exempt such electricity from the hourly matching requirement and consider doing the same in the case of distributed renewable energy that is connected to the grid. Similarly, another comment requested that the Treasury Department and the IRS reconsider the hourly matching requirement and recommended alternative compliance methods, such as co-location with clean energy facilities or contractual pairing. Alternatively, one comment recommended that the final regulations employ a CO2 accounting approach to address significant indirect emissions. Another comment asserted that temporal matching makes hydrogen production during certain periods of the day or year uneconomical, which leads to a decrease in hydrogen, and so the final regulations should employ a net energy monitoring approach. Another comment requested that the final regulations allow projects to use ''low price'' market signals as a proxy for temporal matching because such an approach would create a transparent market signal for hydrogen production resources to efficiently capture surplus energy by locating and designing facilities to capture and store this excess renewable energy.

Finally, one comment recommended an exception to the temporal matching requirement based on capacity where the final investment decision is made before 2028 with respect to a hydrogen production facility. Specifically, the comment recommended a 15 percent capacity exemption for all regions except California Independent System Operator (CAISO) and a 30 percent capacity exemption in solar intensive regions.

As indicated in the proposed regulations, the three qualifying EAC requirements work together to mitigate the risk of induced grid emissions, as they constitute significant indirect emissions, consideration of which is required by section 45V(c)(1)(A) and section 211(o)(1)(H) of the Clean Air Act. As noted in the DOE Technical Paper, and supported by multiple comments, the three requirements address both operational (short-term) and structural (long-term) effects that can cause induced grid emissions and thus affect lifecycle emissions outcomes. Further discussion as to why an exception to the qualifying EAC requirements for energy generation that is co-located or not connected to the grid is not viable is discussed in part III.D.1 in this Summary of Comments and Explanation of Revisions. Given these findings and upon the advice of the DOE and the EPA, these final regulations do not add any additional exceptions to the hourly matching requirement, with the exception for clarifying the use of energy storage, as explained in part III.D.3.c.v of this Summary of Comments and Explanation of Revisions. Any such exceptions increase the risk of significant indirect emissions in the form of induced grid emissions that must be taken into account under the statute in determining the lifecycle GHG emissions rate.

Many comments stated that, if the Treasury Department and the IRS impose a temporal matching requirement, then hydrogen production facilities located in States with statutorily mandated clean energy policies should be deemed to have already met those Federal requirements. One comment recommended that hydrogen production facilities located in such States or regions should receive a waiver of the requirement for hourly matching. Other comments stated that, because hourly matching imposes a significant cost, section 45V accounting should instead require clean hydrogen production facilities in California and other similarly situated States to apply the same temporal matching system that those States apply to other carbon-free technologies, like batteries.

As described in part III.D.3.b.iv of this Summary of Comments and Explanation of Revisions, the Treasury Department and the IRS agree with these comments that certain States have enacted policies that effectively address the risk of induced grid emissions. However, these State policies only address the incrementality requirement; temporal matching and deliverability requirements must still be met. Temporal matching on an hourly basis ensures that there is actual alignment between the timing of generation and the additional load created by the production of hydrogen. Put another way, the temporal matching and deliverability requirements together ensure that the hydrogen producer could consume the incremental generation it is claiming by virtue of such generation being deliverable to the producer at the same time the electricity is being consumed. These requirements enable the hydrogen producer to assert that its hydrogen production is utilizing electricity generation with no (or minimal) direct emissions, and to reduce the risk of induced grid emissions. The incrementality requirement is additionally necessary to ensure that use of zero- or minimal-

emitting generation does not indirectly lead to significant increases in emissions elsewhere on the grid. State policies that meet certain requirements can obviate the need for the incrementality requirement by providing certainty that use of any clean power generation will not indirectly lead to an increase in emitting generation. But to qualify for the section 45V credit, the facility still needs to demonstrate availability of the use of such generation to produce the qualified clean hydrogen in the first place, necessitating the purchase and retirement of EACs that meet the temporal matching and deliverability requirements. Accordingly, these final regulations do not adopt these comments.

Another comment noted that there should be a Scope 2 attribute approach with a small amount of operational flexibility. The Scope 2 approach, specifically referencing the Greenhouse Gas Protocol's market-based methodology, is based on the attributes of the electricity supply, accounting for the conveyance of those attributes via market-based mechanisms such as EACs. The market-based methodology for calculation of Scope 2 emissions calculates hourly grid carbon intensity by deliverability region rather than the current location-based methodology. The Treasury Department and the IRS are unsure of the nature of this request. However, the DOE has advised that the lack of consistent, comprehensive, real-time, national data on hourly marginal emissions prevents implementing hourly marginal emissions as the regional default rates employed in 45VH2–GREET. The DOE Technical Paper also notes the limits to solely relying on short-run marginal emissions rates that exclude structural effects. Additionally, it is difficult to envision how a clean hydrogen producer would utilize those data in real time were they available and implemented in 45VH2–GREET. As such, the Treasury Department and the IRS understand that 45VH2–GREET will retain the regional, annual average grid emissions rate as the default emissions rate. The Treasury Department and the IRS reiterate, however, that a clean hydrogen producer may purchase qualifying EACs as a means to select an alternative to using 45VH2–GREET's default emissions rate for the regional grid and may select the electricity source technology (for example, solar and wind) of the specific electricity generator(s) from which it has purchased qualifying EACs as part of the calculation determining its lifecycle GHG emissions.

v. Treatment of Energy Storage

Several comments requested clarification on how the temporal matching requirement applies to energy storage. Some comments suggested a provision setting the temporal matching time stamp for stored green energy to the time of dispatch from the storage unit, not to the time of generation of the energy or the time of storage. Comments explained that this incentivizes renewable energy storage and will lead to greater levels of temporal matching.

Some comments requested implementing a ''portfolio'' method to allow temporal matching from a ''portfolio'' of clean energy assets. Such comments advocated allowing temporal matching from both behind-the-meter and front-of-the-meter energy storage. However, one comment expressed concern with implementing a ''portfolio'' method. This comment noted that tracking EACs of stored electricity over time is complicated by issues such as carbon-free energy content, round-trip efficiency loss, and nuances of energy storage operations including ancillary services.

The Treasury Department and the IRS acknowledge the growth of electricity storage and the ability of such storage to shift the hourly temporal profile of clean generation. Similarly, storage sited at a clean hydrogen production facility may shift the hourly load of that facility. Therefore, these final regulations will allow temporal shifting of clean generation, but the ability of entities to claim and verify the use of energy storage is contingent on whether and when EAC registries can substantiate the effective tracking of electricity through that storage. Specifically, § 1.45V–4(d)(3)(ii)(C) will allow hydrogen producers and their electricity suppliers to use electricity storage to shift the temporal profile of EACs based on the period of time in which the corresponding electricity is discharged from storage. However, such allowance is predicated on certain requirements. An EAC meets the requirements of § 1.45V–4(d)(3)(ii)(A) if the electricity represented by the EAC is discharged from a storage system in the same hour that the taxpayer's hydrogen production facility uses electricity to produce hydrogen. The storage system must also be located in the same region as both the hydrogen production facility and the facility generating the electricity to be stored. Storage systems need not themselves meet the incrementality requirement, but the EACs that represent electricity stored in such storage systems must meet the incrementality requirement based on the attributes of the generator of such electricity. EACs that represent the attributes of stored electricity for purposes of section 45V must be retired in EAC registries that ensure that such EACs support energy use claims without double counting; ensure that the volume of energy use substantiated by such EACs accounts for storage-related efficiency losses; develop frameworks that comprehensively address storage, that is, do not allow selective reporting of EACs of stored electricity; and develop frameworks for estimating the temporal profile of stored and discharged electricity represented by EACs, including when storage is charged with multiple electricity generators, not all of which produce sufficiently minimal emissions to produce hydrogen that qualifies for the section 45V credit. If an EAC satisfies these basic conditions and its acquisition and retirement can be substantiated by an EAC registry, then such EACs may meet the temporal matching requirement based on the time the stored electricity is discharged.

Some comments asked that hydrogen producers also be allowed to contract with off-site electricity storage to shift their load profile. These final regulations do not offer this option as it adds an additional layer of administrative complexity. The previously described allowances for on-site energy storage to shift load (verifiable through meter readings) and off-site energy storage to shift clean power production profiles (verifiable via EAC registries that develop that capability) provide adequate flexibility for clean hydrogen producers without adding another administratively complex option.

Another comment suggested that the Treasury Department and the IRS require EAC fractionalization to the nearest kilowatt hour (kWh) (0.001 MWh) so credit calculations can be accurate and because, in some regions, a difference of a single kWh is enough to move a taxpayer from one section 45V credit tier to another tier. Concerning fractionalization of EACs, the technical details for tracking qualifying hourly EACs are best left to EAC registries. As described in part III.D.3.c.ii of this Summary of Comments and Explanation of Revisions, hourly matching of EACs is required by 2030. Other rules in these final regulations similarly will require EAC registries to develop new capabilities. The Treasury Department and the IRS encourage EAC registries to work together and with external

stakeholders to develop appropriate, common approaches to tackling these new issues. More broadly, some comments asked the Treasury Department and the IRS to establish a specific standard for hourly EACs, such as EnergyTag. While the Treasury Department and the IRS acknowledge that standardizing the approach to hourly matching across EAC registries would be valuable, these final regulations do not require such a comprehensive standard at this time given potential risks in doing so and the limited comment record.

vi. Temporal Matching and Interaction With Annual Emissions Averaging

Several comments noted that 45VH2–GREET does not facilitate hourly data or calculations. One comment recommended that, if the Treasury Department and the IRS implement hourly matching on January 1, 2028, then 45VH2–GREET should be updated to reflect grid emissions on an hourly basis (rather than on an annual basis) to ensure the highest level of accuracy, incentivize the use of electrolysis during periods of low grid emissions, and better tie hydrogen production to periods of operations. Alternatively, one comment requested additional guidance on how data from hourly EACs should be aggregated and applied to create the required annual average grid mix for purposes of 45VH2–GREET. As support, the comment contended that aggregating data on a more granular basis to support the higher-level input into 45VH2–GREET would reduce administrative burden and achieve the same intended outcome. The same comment also asserted that 45VH2–GREET should not be performing hourly lifecycle calculations because doing so would be too tedious and provide little value.

The Treasury Department and the IRS acknowledge that the current version of 45VH2–GREET does not represent grid emissions on an hourly basis. Carbon intensities of regional grids in the model are currently based on estimates of average generation mixes in a given year, as described in the 45VH2–GREET User Manual. The current model therefore reflects GHG emissions associated with regional grid electricity production and transmission on the basis of annual averages. The DOE has advised that representation of regional grid emissions on an hourly basis is not technically feasible within the current model and is not expected to be feasible in the near future, given lack of high-fidelity data and streamlined modeling capabilities available at this granularity. This is especially true given the need to account for both operational and structural effects in emissions modeling.

Separately, as described in § 1.45V–4(a)(2), qualified clean hydrogen production facilities will be permitted to perform sub-annual (hourly) accounting of their lifecycle GHG emissions associated with electricity used in a hydrogen production process for section 45V credit tier eligibility determinations, subject to certain conditions, once the hourly matching requirement begins in 2030. This sub-annual accounting approach will allow facilities to reflect emissions from electricity consumption on an hourly basis if the electricity is procured from a specific generator and the consumption of that electricity is verified via the purchase and retirement of qualifying EACs. 45VH2–GREET may require updates to enable this method. More information on methods to estimate emissions on a sub-annual basis will be available in future 45VH2–GREET supporting documentation.

d. Deliverability

Proposed § 1.45V–4(d)(3)(iii) would provide that an EAC meets the deliverability requirement if the electricity represented by the EAC is generated by a facility that is in the same grid region as the hydrogen production facility. ''Region'' would be defined in proposed § 1.45V–4(d)(2)(vi) as a region derived from the National Transmission Needs Study that was released by the DOE on October 30, 2023 (DOE Needs Study).[38] Alaska, Hawaii, and each U.S. territory would be treated as separate regions.

i. Alternative Deliverability Regions

While many comments supported the proposed rule's definition of geographic regions, some variously suggested larger, smaller, or different regions. Many comments requested that something other than the DOE Needs Study be used as the basis for the deliverability regions, such as the six North American Electric Reliability Corporation (NERC) regions, the FERC power markets, the Balancing Authority Areas, the existing tradeable REC markets, the three large interconnection regions (that is, Eastern, Western, and ERCOT), and the power pool boundaries and interregional transmission. There were several unique proposals made by individual comments. One comment argued that deliverability regions should reflect transmission links between NERC regional reliability councils and market alignment such as the Western Energy Imbalance Market (WEIM) with the Western Energy Imbalance Service Market (WEIS). Other comments asked for Independent System Operator (ISO) areas to be used as the deliverability regions, or that regions should accord with existing regional tracking systems (for example, the Western Electricity Coordinating Council (WECC) and WREGIS). Another comment proposed that Regional Transmission Organization (RTO)- or ISO-defined local areas be used to establish deliverability for EACs, offering Midcontinent Independent System Operator (MISO) Local Resource Zones as an example. One comment requested that co-location within the same RTO be treated as establishing deliverability. One comment stated that the final regulations should provide a correct and consistent definition of the MISO and Southwest Power Pool (SPP) grids where a facility is located in an area served by both. Another comment asked that the final regulations explicitly state that each U.S. balancing authority is linked to a DOE Needs Study region, claiming that this is already in the 45VH2–GREET User Manual. Finally, one comment argued that the location of an electricity generator and of a hydrogen production facility should be determined by the balancing authority with which the facility is interconnected, not strictly its geographic location.

Regarding specific regions, some comments asked that the SPP region be considered its own deliverability region; that MISO be treated as one deliverability region, rather than as two; that the entire WECC be used as a deliverability region in the Western U.S.; and that WECC be treated as two regions based on the WEIM and the WEIS.

The final regulations retain the proposed regulations' general framework for drawing the regional boundaries, which were derived from the DOE Needs Study. To clarify the regions, the final regulations add a table of balancing authorities and their corresponding regions. The table published in these final regulations is the definitive source for identifying the regions. A copy of this table is also reprinted in the forthcoming 45VH2–GREET User Manual (January 2025). In response to comments seeking clarification regarding how to determine the appropriate region, the final regulations provide in § 1.45V–4(d)(3)(iii)(A) that the electricity generating source and the hydrogen production facility are located in the same region if they are both electrically

[38] U.S. Department of Energy, National Transmission Needs Study, (Oct. 2023) available at *https://www.energy.gov/gdo/national-transmission-needs-study* (click ''Read the Full Report'').

interconnected to a balancing authority (or balancing authorities) that is located in the same region, as identified in the table provided in § 1.45V–4(d)(2)(ix). For example, a hydrogen production facility that is electrically interconnected to the East Kentucky Power Coop, Inc. Balancing Authority and an electricity generating source that is electrically interconnected to the Ohio Valley Electric Corp. Balancing Authority are both in the Mid-Atlantic Region as reflected in the table. Accordingly, the hydrogen production facility and the electricity generating facility are in the same region for purposes of proposed § 1.45V–4(d)(2)(vi) (now renumbered as § 1.45V–4(d)(2)(ix) and (3)(iii)(A).

While the map shown in the 45VH2–GREET User Manual may be a useful visual guide, it is the table and the balancing authority (or authorities) to which the hydrogen production facility and electricity generating source are electrically interconnected that defines the section 45V region. The MISO balancing authority is split between MISO North/Central and MISO South, as described in the table published in these final regulations and as shown in the map in the 45VH2–GREET User Manual. Alaska, Hawaii, and each U.S. territory are treated as separate regions. To the extent modifications to the balancing authorities and their corresponding regions are made in the future based on additional analysis by the DOE, taxpayers may continue to use the table published in these final regulations. In addition, the Treasury Department and the IRS intend to issue a safe harbor that would be published in the *Internal Revenue Bulletin* that would allow taxpayers to use a modified table of balancing authorities and their corresponding regions instead of the table published in these final regulations.

As described in the proposed regulations, the DOE has advised that these regions provide reasonable assurances of deliverability of electricity because they were developed by the DOE in consideration of transmission constraints and congestion and, in many cases, match power-systems operational regions. The DOE has also advised that they reasonably match market and transmission planning regional boundaries (for example, Southeastern Regional Transmission Planning, and PJM Interconnection), in line with many suggestions from comments. Because of this, these regions remain the best geographic representation of deliverability for purposes of the qualifying EAC requirements.

The Treasury Department and the IRS recognize that transmission limitations also exist within these specified regions but are not aware of readily administrable options to reflect those grid constraints in a consistent fashion. The DOE Needs Study found that interregional transmission constraints tend to be greater than within-region constraints. With respect to establishing larger regions, whether based on the six NERC regions or otherwise, the DOE has advised that such regions would not reflect important transmission constraints and also do not reflect the primary geographic scope of current regional transmission planning processes. The DOE Needs Study regions more accurately reflect both considerations.

Regarding the comments to treat MISO as one region, the DOE has advised that there are significant transmission constraints between the southern part of the MISO footprint and the central and northern parts; the DOE Needs Study regions track that reality. Accordingly, were a hydrogen producer located in the southern part of MISO to rely on EACs sourced from an electricity generating facility located in the northern part of MISO, for example, there is a significant risk that the hydrogen production would significantly increase induced grid emissions in the southern part of MISO that may not be offset by emissions reductions to the northern part of MISO.

Regarding the comments on transmission planning and availability in the western U.S., the DOE has advised that the DOE Needs Study better reflects regions than do other stakeholder proposals. Use of market structures like the WEIS/WEIM are not currently recommended by the DOE because these boundaries are based on market operations—such as setting the wholesale price of energy production—that do not necessarily reflect transmission planning and availability. Furthermore, current WEIS/WEIM boundaries change year-to-year, with substantial changes also anticipated in the coming years based on voluntary utility participation decisions that are not centered on transmission availability. Although these comments are not adopted, the final regulations allow interregional delivery in certain circumstances, as described in § 1.45V–4(d)(3)(iii)(B) and part III.D.3.d.iii of this Summary of Comments and Explanation of Revisions, which should address some of the concerns expressed in the comments.

At least one comment noted possible inaccuracies in the 45VH2–GREET User Manual map, for example, a portion of Florida is shown as being in the Southeast region and not the Florida region. While the map contained in the 45VH2–GREET User Manual may be a useful visual guide, the table published in these final regulations is the authoritative source regarding the geographic regions used to determine satisfaction of the deliverability requirement. Further, the Treasury Department and the IRS emphasize that the location of an electricity generating source and the location of a hydrogen production facility is based on the balancing authority to which each is electrically interconnected (not the geographic location), with all but one balancing authority linked to a single region. In addition, the regions in the DOE Needs Study were used to derive the deliverability regions, but are not precisely those employed by these final regulations; the DOE Needs Study should therefore not be referenced for determining compliance with the deliverability requirement.

Finally, some comments noted the discrepancy between the regions used in 45VH2–GREET for the default grid emission factors and those proposed for the deliverability requirement. The Treasury Department and the IRS acknowledge that discrepancy and understand that the DOE is planning to update the default grid emissions values in 45VH2–GREET in the near future to align with the regions required for deliverability.

ii. Dynamic Deliverability Regions

Several comments offered ideas about dynamic deliverability rules. A few comments proposed using up-to-date locational marginal prices to infer deliverability and modify the deliverability region boundaries over time accordingly. One of these comments asked that market price differentials and coordination with ISOs and RTOs be used to create and administer smaller deliverability regions that can be adjusted over time. One comment requested that utilities be allowed to use utility-specific GHG emissions information as an alternative to the balancing authority region approach. One comment proposed using contemporaneous balancing authorities as the deliverability regions. Another comment asked for locational marginal emissions to be used to establish deliverability. Another comment requested that deliverability regions be continually updated using the ongoing DOE Needs Study. One comment wrote that deliverability region boundaries should account for market expansion. Finally, one comment requested that deliverability regions be regularly

adjusted to reflect changes in transmission capacity and to resolve conceptual differences with EU deliverability rules.

The deliverability regions are defined in these final regulations based on the balancing authorities they include and were derived from the DOE Needs Study. The Treasury Department and the IRS recognize that it may be appropriate to revise these regions in the future. For example, the geographic reach of a balancing area may change, or transmission expansion may lead to fewer constraints between the current regions. Comments to the proposed regulations expressed a desire to understand how regional boundaries might change in the future.

To allow for reasonable changes to geographic regions, the Treasury Department and the IRS, in consultation with the DOE, intend to revise the regions in future safe harbor administrative guidance published in the *Internal Revenue Bulletin.* Updates to geographic regions would occur at most once each year, and likely less frequently. The types of changes that could occur through future updates include, for example, movements of individual balancing authorities that might modestly increase or decrease the footprint of affected deliverability regions. Taxpayers could continue to utilize the table published in these final regulations, or, alternatively, taxpayers potentially could utilize an updated table provided in guidance published in the *Internal Revenue Bulletin,* subject to any requirements contained in such guidance. In the event of more fundamental changes to the deliverability regions, the Treasury Department and the IRS would propose amendments to these final regulations.

Regarding comments to use locational marginal prices, the Treasury Department and the IRS note that locational marginal prices are not available on a nationwide basis and vary considerably from one year to the next—and even one hour to the next. Use of locational marginal prices would likely lead to incomplete and unstable region definitions. It is therefore unclear how the Treasury Department and the IRS could administer such a process, and how hydrogen producers could then use the resulting regions. Regarding the comment to use utility-specific GHG emissions information, a consistent method for how to map generator facilities' emissions to the transmission system would be needed to implement this solution. While there are examples of this mapping in both industry research and practice, those methods are nascent and not widely applied across all transmission regions. Furthermore, the use of these techniques in establishing geographic boundaries for transmission deliverability have not been tested. Other comments suggesting various dynamic deliverability region benchmarks raise similar administrability concerns, for example, to automatically revise regions in certain circumstances (such as ISO expansion or publication of a new DOE Needs Study). For these reasons, the final regulations do not adopt these comments. To the extent needed, the Treasury Department and the IRS will announce revisions only after careful consideration and as informed by the DOE's technical expertise, to ensure that such revisions are appropriately measuring deliverability.

iii. Interregional Connections

Many comments asked for means of satisfying the deliverability requirement so that certain cases where the electricity generator and the hydrogen production facility are located in separate deliverability regions would still be deemed deliverable. Some of these comments proposed instituting a process allowing individual hydrogen producers to make a showing of actual deliverability across regions, such as through a direct, interregional connection between generator and hydrogen production facility, generation that has secured ''firm or non-firm transmission'' or ''firm transmission rights,'' or that a ''direct contract'' between generator and hydrogen producer should suffice for deliverability. Along similar lines, several comments requested loosening the deliverability requirement such that EACs from electricity generators located in regions adjacent to the hydrogen producer's region should also satisfy deliverability or that deliverability exemptions should be granted for projects located on the boundaries of deliverability regions. One comment wrote that deliverability rules should accommodate interregional transfers by allowing transfer of EACs between the deliverability regions in proportion to the annual, quarterly, or monthly capacity available on those interregional lines. Another comment said that a generator-producer pairing spanning multiple regions should satisfy deliverability when the project's location reduces transmission need. Finally, a few comments requested that deliverability rules permit the use of EACs from outside the United States, with a few comments mentioning Canada and Mexico.

As noted by comments, transmission often exists across regional boundaries. The DOE has advised that electricity trade across regions (and from Canada and Mexico to the United States) is common, with the level of trade varying regionally. The DOE has also advised that if such delivery of electricity and related EACs can be verified on a granular basis, there is no substantive reason to limit such transactions of qualified EACs. The DOE and the EPA have also advised that several EAC registries already have mechanisms to track near-real-time electricity and related EACs that cross regions and are using those methods to reliably track imports. The fact that several EAC registries already validate cross-border transactions for electricity and related EACs on an hourly basis demonstrates administrability. Other EAC registries may also develop the capabilities to validate such cross-region electricity and EAC transactions, in concert with relevant grid system operators. Finally, the EPA has advised that there may be heightened risk of double sale or use of otherwise qualifying EACs in cases of international imports from Canada and Mexico.

Based on these considerations, these final regulations adopt the suggestions of many comments by amending proposed § 1.45V–4(d)(3)(iii) to allow an eligible EAC to meet the deliverability requirement in certain instances of actual cross-region delivery where the deliverability of such generation can be tracked and verified. *See* § 1.45V–4(d)(3)(iii)(B). First, such EACs will only qualify if the underlying electricity generation has transmission rights from the generator location to the region of the clean hydrogen producer and that generation is delivered to (that is, scheduled and then dispatched and settled in) such producer's region. Such electricity delivery must be demonstrated on an hour-to-hour or more frequent basis, with no direct counterbalancing reverse transactions, and must be verified with NERC E-tags or the equivalent. Second, tracking of transmission rights and electricity delivery must occur via the relevant EAC registry; if the relevant EAC registry lacks this capability, such cross-region transactions are not allowed. Third, and finally, imports from Canada and Mexico must additionally include an attestation from the generator that the attributes included in the eligible EACs are not being used for any other purpose, with that attestation included as an attachment to the verification report submitted with the taxpayer's return. These requirements collectively ensure delivery of qualifying EACs and electricity to the importing region, thus

ensuring local displacement of other generation consistent with the producer's load, accurate verification of delivery through EAC registries, and low risk of double counting or multiple use of EACs and their generation attributes.

Some comments sought an individualized process that would allow hydrogen producers to make showings of deliverability on a case-by-case basis, to use transmission rights or direct contracts as an alternative basis for establishing deliverability, to use locational pricing differentials to demonstrate deliverability, or to demonstrate deliverability in other ways. Another comment suggested allowing delivery across regions based on available transmission capacity. Given administrability concerns, these final regulations do not include an individualized process to make a showing of deliverability. Additionally, the Treasury Department and the IRS note that the multiple criteria in § 1.45V–4(d)(3)(iii)(B) to determine interregional deliverability are necessary to ensure that cross-region transactions involve the delivery of actual electricity and related EACs, and several EAC registries already employ such criteria to validate cross-region transactions. These final regulations, therefore, adopt the standardized process and interregional deliverability criteria in § 1.45V–4(d)(3)(iii)(B), which ensure delivery of electricity and EACs as validated by EAC registries.

Another comment asked for clarification as to how electricity generators located in one balancing authority area but treated operationally and financially as if in a different balancing authority area, are treated under the deliverability rules. As described in the Explanation of Provisions of the proposed regulations, the location of an electricity generating source and the location of a hydrogen production facility are based on the balancing authority to which each is electrically interconnected (not its geographic location), with each balancing authority (except MISO) linked to a single region. If the electricity generator is electrically connected to the receiving region, then such a project would be assigned to that region. If not electrically connected, it would need to meet the interregional deliverability requirements. As such, if there is a direct, single-use connection (for example, a high-voltage direct current transmission line) between an electricity generator and a hydrogen producer's region (or the hydrogen producer itself) such that the generator is electrically connected to the receiving region, then EACs reflecting the hydrogen production facility's use of this electricity would meet the deliverability requirement.

Finally, one comment opined that the deliverability requirement is counterproductive to the interregional transmission goals of the DOE Needs Study. The Treasury Department and the IRS disagree with this comment but note that the allowance for cross-region delivery in these final regulations addresses this comment.

iv. Phase-In and Legacy Rules

Several comments requested phase-in or legacy rules. Some comments suggested that projects beginning construction before 2030 should only be required to source EACs from within the same NERC region. Another comment proposed exempting the first 10 gigawatts placed in service before 2031 from the deliverability requirement. Another comment advocated for exempting all hydrogen facilities beginning construction before 2033 from the deliverability requirement. A comment that had proposed the use of tracking systems like WECC in setting deliverability region boundaries requested that, if tracking systems will not be used, then a transition rule should allow projects that have commercial agreements in place to acquire electricity from outside the project's region to meet deliverability until 2032. As described in part III.D.3.a of this Summary of Comments and Explanation of Revisions, the three qualifying EAC requirements, inclusive of deliverability, are necessary to reduce the risk of induced grid emissions in line with the statutory lifecycle emissions requirement, and phase-in or legacy rules would increase the risk of such emissions.

Several comments expressed concern that regional boundaries might change in the future and asked for rules allowing reliance on the deliverability region boundaries as they are provided at the time a hydrogen production facility is either placed in service or its construction begins. The Treasury Department and the IRS agree with the comments that certainty regarding deliverability regions is important. Therefore, these final regulations adopt the table of regions in § 1.45V–4(d)(2)(ix) for the duration of the section 45V credit. If, in the future the Treasury Department and the IRS publish a revised table as a safe harbor in the *Internal Revenue Bulletin,* a clean hydrogen producer would be able to instead employ such regions prospectively, subject to requirements that may be contained in such guidance.

Some comments sought various phase-in rules, whereby regions are, in effect, larger in the near term but become narrower over time. Multiple variants on this concept were proposed. These final regulations do not provide such a phase in. As previously discussed, the three qualifying EAC requirements, inclusive of deliverability, are necessary to reduce the risk of induced grid emissions in line with the statutory lifecycle emissions requirement. Accepting a phased-in approach with respect to deliverability would undermine this objective. By contrast to the temporal matching requirement, comments have not identified any technical or administrative reason why the deliverability requirement must be phased in. The Treasury Department and the IRS note, however, that several additional flexibilities are allowed in this final regulation that were not included in the proposed regulations, including allowance of interregional delivery and the ability to utilize the table of regions published in these final regulations over the life of the credit. Such additional flexibilities may partially ameliorate the concerns of some stakeholders.

v. Other Deliverability Comments

Finally, comments described certain overarching concerns with the deliverability requirement. One comment expressed concern that, since deliverability regions do not align with EAC registry boundaries, deliverability could be incompatible in some way with temporality. The Treasury Department and the IRS do not agree with this comment. EAC registries will need to develop new capabilities to fully meet the qualifying EAC requirements, but overlapping or imperfect geographic coverage of the EAC registries should not be an issue. Two EAC registries will operate outside of their native regions, so even if a specific EAC registry is not able to meet all the qualifying EAC requirements, these other EAC registries are available to taxpayers.

One comment asked that projects drawing power from zero- or near-zero emissions grids be exempted from the deliverability requirements. Projects drawing power from zero- or near-zero emissions grids may use the grid average lifecycle GHG emissions rate in determining their section 45V credit eligibility and amount; the deliverability requirement only applies in the event the taxpayer is using EACs instead of the grid average emissions rate. If a taxpayer is using EACs, as described in part III.D.1 of this Summary of

Comments and Explanation of Revisions, the Treasury Department and the IRS agree with comments that certain states have enacted policies that may address the risk of induced grid emissions. However, these state policies will only satisfy the incrementality requirement; temporal matching and deliverability requirements must still be met. Deliverability requirements ensure that the electricity generation that creates the EACs occurs in the same grid region or is otherwise physically deliverable to the EAC buyer's load, even where that generation is incremental or otherwise will not lead to induced grid emissions. Accordingly, these final regulations do not adopt this comment.

E. Underlying Substance of 45VH2–GREET

1. In General

As described in the preamble to the proposed regulations, certain parameters in 45VH2–GREET are fixed assumptions, referred to as ''background data'' in this document. Background data, such as upstream methane loss rates, emissions associated with power generation from specific generator types, and emissions associated with regional electricity grids, may not be changed by users of 45VH2–GREET. Many comments either requested or recommended changes to certain background data and requested clarification with respect to certain background data parameters. Additionally, many comments recommended the inclusion of more background data parameters not currently in 45VH2–GREET. Some comments requested or recommended that certain background data parameters become foreground data (that is, parameters that must be input by the user), or alternatively, that all background data parameters become foreground data.

The Treasury Department and the IRS, in consultation with the DOE, reaffirm the importance of maintaining parameters as background data in cases where idiosyncratic values are difficult to estimate or verify. Examples of such scenarios include the carbon intensity of specific types of electricity generation, such as solar, wind, or nuclear generation. The 45VH2–GREET supporting documentation clearly defines each type of generator currently represented in the model and allows for user inputs in scenarios where independent verification of such inputs is realistically feasible. Certain types of electricity generation like solar and wind do not have emissions within the well-to-gate system boundary, regardless of how they are operated. Such types of generation have been assigned a carbon intensity of zero within 45VH2–GREET. Other types of generation have non-zero emissions, but such emissions will not be transparent to a third-party verifier. For example, well-to-gate emissions from light-water nuclear reactors are largely due to the manner in which uranium is enriched and the countries from which it is sourced. Beyond the sector-wide trends already used to inform 45VH2–GREET, differentiation of such information at a facility-level and associated verification is likely to be infeasible. In other cases, traits of certain types of generation are likely to be verifiable and have therefore been incorporated as foreground data in 45VH2–GREET. One example is the rate of CCS integrated with a natural gas combined cycle turbine used for power generation. Supporting documentation for 45VH2–GREET provides information on how this rate must be calculated, and all aspects of the calculation (for example, the amount of CO2 sequestration reported to the EPA's Greenhouse Gas Reporting Program (GHGRP), and the amount of CO2 generated by the facility) are expected to be verifiable. If a taxpayer utilizes a method of electricity generation that is not yet represented in 45VH2–GREET, then such taxpayer's pathway is not considered to be represented in the model, and the taxpayer may be eligible to petition the DOE for a PER (subject to the requirements of the PER petition process).

Other than background data, aspects of 45VH2–GREET that users may not change include the calculation methods embedded within the model, for example, co-product accounting techniques, and assumptions of global warming potential that are used to calculate lifecycle emissions. The approaches for accounting used in 45VH2–GREET are essential features that define the model itself; if these methods were subject to modifications by a user, different taxpayers with identical hydrogen production pathways could achieve different lifecycle GHG rates. Such inconsistency would violate fair administration of section 45V. Consistent with advice received from the DOE, the methodologies and assumptions embedded in 45VH2–GREET are necessary and appropriate for the accurate and fair administration of the section 45V credit.

The Treasury Department and the IRS had solicited feedback on conditions, if any, under which the methane loss rate may in future releases become foreground data (such as certificates that verifiably demonstrate different methane loss rates for natural gas feedstocks). In response, one comment recommended the use of MiQ certificates, which evidence the emissions intensity of gas production, including methane loss rates. Further, the comment noted that the EPA also has methods available to assess methane loss rates. The DOE had previously indicated in the 45VH2–GREET User Manual that methane emissions monitoring and mitigation is quickly changing. The DOE also had acknowledged certain relevant EPA reporting requirements that could be helpful in mitigating methane emissions, alongside DOE-funded research on mitigation approaches, and together, had indicated that it expected the quality of upstream data to improve and methane emissions rates to change in future versions of 45VH2–GREET.

Methane emissions that occur upstream of the hydrogen production facility can materially affect the well-to-gate emissions associated with hydrogen production. Comments have noted that rates of upstream methane emissions within distinct supply chains vary widely, depending on parameters such as mitigation measures within the basin that natural gas is sourced from, length of pipeline transmission, number of leak sources, and leakage rates from individual point sources. Comments also noted that because of this variation, the default national average leakage rate for natural gas contained as background data in 45VH2–GREET in many cases likely underestimates actual methane emissions associated with producing hydrogen and that the default rate should be updated based on improved science and empirical data. Additionally, the DOE has advised that supply chains and contractual agreements for natural gas are complex and varied, such that some taxpayers may be capable of identifying all upstream suppliers while others may not. The DOE has also advised that measurement, monitoring, reporting, and verification (MMRV) capabilities of upstream methane losses are rapidly advancing.

The EPA's recently updated GHGRP rule in 40 CFR part 98 Subpart W (89 FR 42062, May 14, 2024) prescribes methods that facilities in the natural gas supply chain must use to account for their methane emissions for reporting under the GHGRP and ensures that the reporting of methane emissions to the GHGRP is based on empirical data and accurately reflects total methane emissions from applicable facilities, as required by section 136(h) of the Clean

Air Act. Among these recent updates to the GHGRP are updates to calculation methodologies and the addition of several new emissions sources, including one referred to as ''other large release events,'' to capture emission events that had not been accounted for under the prior version of the program. The GHGRP also collects data related to GHG emissions from combustion of natural gas under Subpart C and production of hydrogen under Subpart P of 40 CFR part 98. The EPA's recently finalized regulations for methane emissions from the oil and gas sector under section 111 of the Clean Air Act, including the creation of the Super Emitter Program and its corresponding publication and notification requirements, expanded leak detection and repair requirements, and flare efficiency measurement and monitoring requirements, will directly inform methane emissions reported to the GHGRP under Subpart W and provide for improved assessments of supply chain methane emissions associated with hydrogen production. *See Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review,* 89 FR 16820 (March 8, 2024).

Applicable natural gas supply chain facilities are required to report to the GHGRP under the revised Subpart W rules beginning in 2026 for emissions occurring in calendar year 2025. As advised by the DOE and the EPA, the accuracy of lifecycle GHG emissions rates for purposes of section 45V will improve once data from the updated GHGRP Subpart W reporting are available from and have been verified by the EPA and incorporated into the determination of such rates for methane. Once these data are available, the DOE will update 45VH2–GREET to allow differentiated methane emissions rate reporting, subject to the requirements described in the following paragraphs.[39] Until 45VH2–GREET is updated to include user-defined emissions based on Subpart W reporting, the DOE has advised the Treasury Department and the IRS that it anticipates keeping the national average upstream methane emissions rate in 45VH2–GREET consistent with the value used in the initial 2023 release of the model.

Giving taxpayers discretion to selectively use either the default national average estimate or a differentiated rate depending on which is more taxpayer favorable would systematically understate the actual upstream production and transportation emissions from methane used to produce hydrogen. Therefore, when 45VH2–GREET is updated to enable input of differentiated upstream methane rates, it will require taxpayers to use data from all relevant subparts of GHGRP for all facilities in the taxpayer's natural gas supply chain that are required to report under Subpart W, while prescribing the use of default segment-specific emissions rates for petroleum and natural gas systems not otherwise reporting their GHG emissions under the revised rules under the GHGRP to more accurately reflect leakage rates of these facilities. These default segment-specific emissions rates will be developed by the DOE and the EPA based on data for each segment reported to the GHGRP, as well as peer-reviewed scientific literature.

To ensure the accuracy and integrity of the information used to claim the section 45V credit, taxpayers must meet the requirements of section 45V and these final regulations, including the requirement to obtain verification from an accredited third-party verifier. In particular, consistent with § 1.45V–5(c), verification is required for the data the taxpayer enters into the 45VH2–GREET Model to determine the lifecycle GHG emissions rate, which in the case of differentiated methane rates must include identification of all facilities in the natural gas supply chain, identification of the facilities in the natural gas supply chain that are required to report to the GHGRP, accurate reporting of verified GHGRP data for these facilities, accurate throughput data, and appropriate application of any segment-specific default rates.

The EPA's revised Subpart W and Clean Air Act section 111 rules, together, are essential to the determination that differentiated upstream methane rates are appropriate and robust because they provide accurate, detailed, and particularized data on a facility's natural gas supply chain methane emissions. To maintain accuracy in determining the section 45V credit, upstream methane emissions rates must be maintained as background data in 45VH2–GREET until the verified GHGRP data collected under the revised GHGRP rules are available. Additionally, if those rules are rescinded, or revised in a manner that reduces the scope, stringency, accuracy, or reliability of emissions reporting under Subpart W, Subpart C, or Subpart P, if the EPA does not maintain the current requirements of the Super Emitter Program or does not take necessary implementation steps—including continuing to receive data on super emitters from third party notifiers, publishing that data on the web, and sending notifications of super emitter events to responsible owners and operators[40]—then upstream methane emissions rates would need to be maintained as background data in 45VH2–GREET to maintain accuracy in determining the section 45V credit.

As stated in the Explanation of Provisions to the proposed regulations, future versions of 45VH2–GREET may include additional hydrogen production pathways, such as geologic hydrogen, as sufficient technical information becomes available to provide consistent treatment in 45VH2–GREET. Numerous comments either requested or recommended that certain hydrogen production pathways be included in or excluded from future versions of 45VH2–GREET. Similarly, many comments also either requested or recommended that future versions of 45VH2–GREET modify existing feedstocks and include additional feedstocks and power sources for hydrogen production.

The Treasury Department and the IRS understand, based on feedback received from the DOE, that some technologies and feedstocks were not included in the initial version of 45VH2–GREET because they required further analyses. The Treasury Department and the IRS anticipate 45VH2–GREET will be updated on at least an annual basis and that such updates are expected to include additional technologies and feedstocks. Finally, several comments expressed a desire for more transparency with respect to the initial development and implementation of 45VH2–GREET, as well as future updates to the model, including requests that future updates to 45VH2–GREET be submitted for notice and comment. For purposes of determining

[39] The DOE also expects to update 45VH2–GREET to similarly allow differentiated reporting of other upstream emissions associated with the natural gas supply chain to the extent these are similarly reported in the GHGRP and verified by EPA.

[40] The determination that the current Subpart W and section 111 rules are adequate to support facility-specific upstream methane leakage calculations is based on the following rules: Greenhouse Gas Reporting Rule: Revisions and Confidentiality Determinations for Petroleum and Natural Gas Systems, 89 FR 42062 (May 14, 2024), *as corrected by* 89 FR 71838 (Sept. 4, 2024); Standards of Performance for New, Reconstructed and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review, 89 FR 16820 (Mar. 8, 2024), *as corrected by* 89 FR 62872 (Aug. 1, 2024). Amendments to the Subpart W rule and Standards of Performance and Emissions Guideline rule made pursuant to specific grants of reconsideration announced for Subpart W in December 2024 and for the section 111 rule in May 2024, will not be considered a rescission or revision as described herein.

lifecycle GHG emissions as generally defined in section 45V(c)(1)(A), the Treasury Department and the IRS have relied extensively on the DOE, which has the scientific expertise necessary to develop GREET models, and through the Argonne National Laboratory developed 45VH2–GREET pursuant to section 45V(c)(1)(B). The comments' request that all future updates to 45VH2–GREET be put through notice and comment is not applicable to these final regulations, which are limited to focusing on the Treasury Department's designation of 45VH2–GREET as the operative model for the purposes of the section 45V credit. The Treasury Department and the IRS have shared these comments with the DOE to determine the best way to address comments related to future updates to 45VH2–GREET.

2. Valorized Co-Products

As noted in the Explanation of Provisions to the proposed regulations, 45VH2—GREET allows users to input the quantity of valorized co-products (that is, co-products from the hydrogen production process that are separately productively utilized or sold) and allocate emissions to those co-products (rather than to the hydrogen production). The Explanation of Provisions to the proposed regulations also described that 45VH2–GREET utilizes the ''system expansion'' approach for all co-products, if possible, but restricts the amount of steam co-products that producers can claim based on the quantity of steam that an optimally designed reformer is expected to be capable of producing according to modeling from the National Energy Technology Laboratory (NETL).

The Treasury Department and the IRS had solicited feedback on this approach, including whether alternative conventions for co-product accounting, such as physical allocation or allocation based on other characteristics, would better ensure that well-to-gate carbon intensity of hydrogen production is robustly represented. Comments received in response to this request were generally supportive of the restriction on steam co-products described above. Some comments, however, expressed concern that 45VH2–GREET fails to account for steam co-products if a reformer is capturing and sequestering the CO2 it produces.

The DOE has advised that steam co-products were not represented for reformers with CCS in the initial release of 45VH2–GREET because the model did not yet represent CCS technologies wherein steam co-products were feasible. The DOE has advised that cryogenic CCS technologies have been included in the forthcoming January 2025 release of 45VH2–GREET, and that steam co-products can be represented from reformers with cryogenic CCS. The DOE intends to continue to expand 45VH2–GREET with additional CCS technologies, and to allow for steam co-products to be represented if it is feasible with such technologies. However, 45VH2–GREET will not allow reformers (with or without CCS) claiming steam co-products to claim co-products in excess of 17.6 percent of the total energy content of all steam and hydrogen produced (using the lower heating value of hydrogen). This limit of 17.6 percent is based on independent modeling of optimally designed reformers from the NETL and is described further in the 45VH2–GREET User Manual.

Additionally, the DOE has advised that system expansion may not be an appropriate accounting approach for all co-products that may be produced at hydrogen production facilities, and that physical allocation should be utilized where system expansion is inappropriate. Specifically, system expansion may be inappropriate if it yields artificially low lifecycle GHG emission values for hydrogen in scenarios that include but are not limited to scenarios where incumbent methods of co-product generation have highly variable or uncertain lifecycle GHG emission values or scenarios where the market for the co-product is sufficiently small that the magnitude of the co-product generated by hydrogen producers is likely to expand the market size of the co-product rather than displacing an incumbent technology. Therefore, in scenarios wherein system expansion may not be appropriate, 45VH2–GREET will utilize physical allocation.

As previously noted, 45VH2–GREET allows users to allocate emissions to co-products, rather than to the hydrogen production. The DOE has also advised that a co-product under 45VH2–GREET does not include a gas or output that is not separate from (that is, is mixed in with) the hydrogen gas stream, even if the mixed gas is valorized as part of the stream. Nor does it include an output that has been separated from a hydrogen gas stream if the taxpayer or a customer downstream of the taxpayer will later mix such output back into the hydrogen gas stream. In such cases, the user must evaluate the emissions of the hydrogen production process before the output was separated out, and account for the output as a mixed gas or impurity.

An example where output may not be treated as a co-product is the scenario where a taxpayer uses natural gas to produce a hydrogen gas stream that includes carbon monoxide, and separates the carbon monoxide from the hydrogen gas stream. The taxpayer sells the carbon monoxide to Customer A, sells the hydrogen to Customer B, and intends to account for the carbon monoxide in 45VH2–GREET as a co-product. Later, Customer A sells the carbon monoxide to Customer B, and Customer B combines such carbon monoxide with the hydrogen to produce methanol. Because the carbon monoxide will be reintroduced to the hydrogen after it is separated, the carbon monoxide may not be treated as a co-product.

F. Non-Zero-Emitting Sources of Electricity

In the Explanation of Provisions to the proposed regulations, the Treasury Department and the IRS requested comments with respect to sources of electricity other than zero GHG-emitting electricity, including minimal-emitting and non-minimal-emitting sources. The Treasury Department and the IRS received comments in support of the use of such sources, many of which proposed extensive verification requirements. On the other hand, one comment stated that the final regulations should require that minimal-emitting electricity generating facilities submit a full lifecycle analysis before any EACs with respect to such facilities are allowed to be issued to hydrogen producers because the qualifying EAC requirements generally are not reflected in the attributes of the EACs of such facilities. In consultation with the DOE, the Treasury Department and the IRS intend to allow the use of EACs with respect to sources of electricity other than zero GHG-emitting electricity. Hydrogen produced using minimal-emitting electricity sources may qualify for the section 45V credit if the lifecycle GHG emissions rate of the process by which the hydrogen was produced satisfies statutory requirements. Moreover, the Treasury Department and the IRS intend for the EAC framework and the qualifying EAC requirements that apply to these electricity sources to provide one framework for the determination of when electricity from a specific electricity generating facility can be taken into account for purposes of 45VH2–GREET or a PER. These final regulations amend the definition of ''eligible EAC'' in § 1.45V–4(d)(2)(iii) to require attributes that are required by 45VH2–GREET or in the determination of a PER to accurately reflect the

emissions associated with the source of electricity.

In addition, the Treasury Department and the IRS, in consultation with the DOE, note that 45VH2–GREET currently includes certain minimal-emitting electricity source options, including allowing hydrogen production facilities to account for electricity generation using CCS, and it may include additional minimal-generating options in the future. These final regulations also include requirements limiting when carbon capture may be taken into account, which are discussed in part III.G of this Summary of Comments and Explanation of Revisions. Hydrogen production facilities using types of electricity generation not represented in 45VH2–GREET will be eligible to submit petitions for PERs. To the extent that a non-zero, minimal-emitting electricity source is used to power hydrogen production, the direct and significant indirect emissions from the minimal-emitting source of electricity must be reflected in 45VH2–GREET or as part of an Emissions Value Request Application. Foreground data parameters relevant to electricity sources (for example, the amount of CCS) must be verified by a third-party verifier. The Treasury Department and the IRS expect that verifiers will develop tools to verify the feedstock sources and related energy attributes represented by the EACs.

G. Carbon Capture and Sequestration

Hydrogen production facilities may employ carbon capture equipment and engage in CCS. Several comments stressed the importance of verification of carbon capture rates reported by hydrogen producers claiming the section 45V credit. One comment asked that requirements for the verification of CO2 capture rates and the permanence of CO2 sequestration be as rigorous as those of the California Air Resource Board's (CARB) Carbon Capture and Sequestration Protocol for the CA LCFS. Another comment requested (1) that verification requirements for carbon oxide transport, permanent storage or use, or monitoring under section 45V be at least as stringent as those under section 45Q; (2) that proof of at least three years of injection site monitoring by an independent geologist or petroleum engineer should be required in the case of CO2 sequestered or used for enhanced oil recovery; and (3) that the final regulations include provisions specifying proper verification of carbon management, including sequestration and prevention of CO2 leaks, and also include a clawback mechanism in the case of CO2 leaks. In cases where electricity, fuel, or a feedstock is used to produce hydrogen, the issue of carbon capture rate verification also arises if the source of electricity, fuel, or feedstock is engaged in CCS. Thus, in response to these comments, the final regulations add § 1.45V–4(e), which provides that for purposes of the section 45V credit, if a taxpayer determines a lifecycle GHG emissions rate for hydrogen produced at a hydrogen production facility using the 45VH2–GREET Model or the Secretary determines a PER for hydrogen produced at a hydrogen production facility subject to a PER petition, then CCS may be taken into account only if the carbon capture occurs in the production of qualified clean hydrogen (for subsequent sequestration) or occurs in the production of electricity, fuel, or feedstock that is used by such facility to produce hydrogen and is captured and, pursuant to section 45Q(f)(2) and any regulations established thereunder, disposed of in secure geological storage, or utilized in a manner described in section 45Q(f)(5) and any regulations established thereunder. Such CCS that occurs in the production of qualified clean hydrogen (rather than in the production of electricity, fuel, or feedstock) may only be taken into account if the carbon capture equipment is part of the qualified clean hydrogen production facility. Any CCS that does not meet such section 45Q requirements will appropriately be considered to be emissions from the production of hydrogen within the well-to-gate system boundary and be attributed to the lifecycle GHG emissions of such hydrogen. Because CCS rates are reported and verified on an annual basis for purposes of section 45Q or reporting under the EPA's GHGRP program, the annual average CCS rate at a given electricity generating plant can be applied to any EACs that are sourced from that generating resource when it is represented in 45VH2–GREET or an Emissions Value Request Application. Power sourced from facilities with CCS must meet all other requirements for qualifying EACs in these final regulations.

In addition, the Treasury Department and the IRS note that the amount of CO2 sequestered by an electricity source generator or by a hydrogen production facility using carbon capture equipment is foreground data within 45VH2–GREET and therefore also is subject to third-party verification.

H. Use of Natural Gas Alternatives

The Treasury Department and the IRS announced in the preamble to the proposed regulations an intent to provide final regulations addressing hydrogen production pathways that use biogas, renewable natural gas (RNG), and fugitive sources of methane (collectively, natural gas alternatives), for purposes of the section 45V credit. The assessment of lifecycle GHG emissions with respect to such natural gas alternatives presents a complex set of technical questions. Thus, the preamble to the proposed regulations described various rules related to the use of natural gas alternatives in the production of hydrogen that the Treasury Department and the IRS were considering for inclusion in these final regulations. The preamble to the proposed regulations also included detailed comment requests about various aspects of the use of natural gas alternatives to inform the development of these final regulations. After careful consideration of the numerous comments submitted in response to these proposals and the proposed regulations' specific requests for comment, the final regulations provide rules in § 1.45V–4(f) related to the use of natural gas alternatives in the production of hydrogen and the assessment of lifecycle GHG emissions with respect to natural gas alternatives. As further described in part III.H.2.c of this Summary of Comments and Explanation of Revisions, rather than provide rules that would specify a single, generic alternative fate for all natural gas alternatives (for example, capture and flaring), the Treasury Department and the IRS have, in consultation with interagency technical experts from the DOE and the EPA, considered the technical characteristics of types of sources of natural gas alternatives and sought to apply the approach most appropriate for each type of source to provide an administrable and robust alternative fate for each sector.

1. Definitions

a. Alternative Fate

The preamble to the proposed regulations asked for comments on what counterfactual assumptions and data should be used to assess the lifecycle GHG emissions of hydrogen production pathways that rely on natural gas alternatives. The preamble to the proposed regulations did not offer a definition of the term ''counterfactual,'' which is referred to in these final regulations as an ''alternative fate.'' In the interest of completeness and clarity, § 1.45V–4(f)(2)(i) clarifies that the term ''alternative fate'' means a set of informed assumptions (for example, production processes, material outcomes, and market-mediated effects)

used to estimate the emissions from the use or disposal of each feedstock were it not for the feedstock's new use due to the implementation of policy (that is, to produce hydrogen).

b. Biogas

The preamble to the proposed regulations noted that the term biogas means ''gas resulting from the decomposition of organic matter under anaerobic conditions, and the principal constituent is methane (50–75 percent).'' Some comments noted that biogas may contain a percentage of methane that is outside of the range noted in the proposed regulations. In order to be inclusive of all gases that may be considered biogas, § 1.45V–4(f)(2)(ii) does not specify a range of percentages of methane that a gas must contain to be considered biogas. These final regulations define biogas as gas containing methane that results from the decomposition of organic matter under anaerobic conditions.

c. Coal Mine Methane

The preamble to the proposed regulations did not offer a definition of the term ''coal mine methane,'' but, in the interest of completeness and clarity, § 1.45V–4(f)(2)(iii) clarifies that the term ''coal mine methane'' means methane that is stored within coal seams and is liberated as a result of current or past mining activities. ''Liberated'' coal mine methane can be released intentionally by the mine for safety purposes, such as through mine degasification boreholes or underground mine ventilation systems, or it may leak out of the mine through vents, fissures, or boreholes. For the purpose of these regulations, the term coal mine methane does not include methane removed from virgin coal seams (for example, coal bed methane).

d. Fugitive Methane

The preamble to the proposed regulations would have defined the term ''fugitive methane'' to mean the release of methane through, for example, equipment leaks, or venting during the extraction, processing, transformation, and delivery of fossil fuels to the point of final use, such as coal mine methane. Comments did not recommend alternatives to this definition. The proposed definition is adopted in these final regulations without substantive change in § 1.45V–4(f)(2)(iv). One comment asserted that the proposed definition creates a distorted baseline assumption that methane would have been leaked or vented, such that the captured methane could improperly be assessed as having negative lifecycle GHG emissions. The Treasury Department and IRS understand this concern and note that the baseline and alternative fates relevant to certain sources of fugitive methane are further discussed at part III.H.2.c of this Summary of Comments and Explanation of Revisions.

e. Renewable Natural Gas

The preamble to the proposed regulations would have defined the term ''renewable natural gas'' (RNG) to mean ''biogas that has been upgraded to be equivalent in nature to fossil natural gas.'' One comment asserted that the term ''renewable natural gas'' is misleading and should be replaced with the term ''biomethane.'' This comment noted that referring to biomethane as a ''renewable'' resource falsely implies that it is easily replaced although biomethane is scarce and its supplies are often depleted upon use. Although the Treasury Department and the IRS recognize these concerns, § 1.45V–4(f)(2)(iv) does not adopt the suggested change in terminology because the term ''renewable natural gas'' is sufficiently clear, is a commonly used term in other regulatory programs and in commerce, and is unlikely to result in confusion. The term ''renewable natural gas'' and its proposed definition is therefore adopted without substantive change.

2. Considerations Regarding the Lifecycle GHG Emissions Associated With the Production of Hydrogen Using Methane From Natural Gas Alternatives

The preamble to the proposed regulations explained that the rules provided in the final regulations regarding natural gas alternatives would apply to all natural gas alternatives used for purposes of the section 45V credit and would provide conditions that must be met before certificates for natural gas alternatives (that is, representations of the energy and emissions attributes of the methane) and the attributes they are meant to represent may be taken into account in determining lifecycle GHG emissions rates for purposes of the section 45V credit. The preamble to the proposed regulations indicated that such conditions would be logically consistent with, but not identical to, the incrementality, temporal matching, and deliverability requirements for electricity-derived EACs, in that the conditions would be designed to reflect the ways in which additional demand for natural gas alternatives can impact lifecycle GHG emissions and also to address the differences between electricity and methane, including, but not limited to, the different sources of emissions, markets, infrastructure, available tracking and verification methods, and potential for perverse incentives.

The preamble to the proposed regulations described and requested comment on several provisions the Treasury Department and the IRS were considering adopting in the final regulations to address the risk of significant indirect emissions and induced emissions from the use of natural gas alternatives in the production of hydrogen. This risk of significant indirect emissions and induced emissions can arise when natural gas alternatives are diverted from another productive use. In these situations, such productive uses may be backfilled with a different source that is not a natural gas alternative, such as fossil natural gas, which could result in associated emissions. For example, a facility that previously used its biogas for heat and power generation may opt to import grid electricity and/or fossil natural gas to satisfy its on-site energy needs. There is also a risk of significant indirect emissions or induced emissions or inappropriate claims of the section 45V credit with respect to hydrogen that does not meet statutory emissions requirements, if the incentives provided by the section 45V credit result in the creation of new or expanded methane or other GHG sources that would not have existed otherwise, or additional methane that would not have been created or would have remained sequestered, which could increase lifecycle GHG emissions. By reference to section 211(o)(1)(H) of the Clean Air Act, section 45V(c)(1)(A) requires consideration of direct and significant indirect emissions.

a. Lifecycle GHG Emissions Associated With the Use of Natural Gas Alternatives

The accurate assessment of lifecycle GHG emissions is vital to determining both eligibility for and the amount of the section 45V credit. Lifecycle GHG emissions assessments that underestimate the emissions associated with different hydrogen production pathways would mean that the section 45V credit could be claimed even if lifecycle GHG emissions in fact exceed the statutory eligibility threshold or credit tier thresholds established by Congress. In order to ensure that hydrogen producers claiming the section 45V credit are using processes with lifecycle GHG emissions that do not exceed the statutorily prescribed eligibility threshold or credit tier thresholds, the final regulations necessarily include certain guardrails to address the risk of such credit claims.

The preamble to the proposed regulations requested comments on the lifecycle analysis considerations for methane derived from natural gas alternatives. To account for direct and significant indirect emissions, these considerations include, among other things, appropriate alternative fate scenarios and the assessment of current feedstock management practices. The preamble to the proposed regulations noted that the requested comments may inform future versions of the 45VH2–GREET model. After consideration of the comments received, the final regulations address certain aspects of the lifecycle GHG emissions analysis for natural gas alternatives used in the production of hydrogen. Parts III.H.2.b. and c. of this Summary of Comments and Explanation of Revisions address first productive use and general alternative fate assumptions ranging from venting to responsible avoidance of methane.

The Treasury Department and the IRS agree with comments that assert that accurately estimating lifecycle GHG emissions rates for processes that rely on methane from natural gas alternatives to produce hydrogen requires taking a wide range of factors into account in establishing the alternative fate against which the use of methane to produce hydrogen should be assessed. Section 45V(c)(1)(A) requires any lifecycle GHG emissions analysis under section 45V to address direct and significant indirect emissions associated with the use of methane for the production of hydrogen, including emissions resulting from the diversion of methane from a prior alternative productive use or from the expansion of existing sources or creation of new sources of natural gas alternatives.

b. First Productive Use

The preamble to the proposed regulations provided notice that the Treasury Department and the IRS intended to require that, for natural gas alternatives to receive an emissions value consistent with that gas (and not fossil natural gas), the natural gas alternative used during the hydrogen production process must originate from the first productive use of the relevant methane. The preamble to the proposed regulations further noted that for any specific source, productive use would generally be defined as any valuable application of the relevant methane (for example, providing heat or cooling, generating electricity, or upgrading to RNG). In addition, the preamble noted that productive use would specifically exclude venting to the atmosphere or capture and flaring. The preamble further proposed to define ''first productive use'' as the time when a producer of the relevant methane first begins using or selling it for productive use in the same taxable year as (or after) the relevant hydrogen production facility was placed in service. Under this proposal, RNG produced from any source of methane, where the methane had been productively used in a taxable year prior to the taxable year in which the relevant hydrogen production facility was placed in service, would not have received an emission value consistent with biogas-based RNG, for example, but would instead have received a value consistent with fossil natural gas. This proposal was intended to address emissions associated with the diversion of natural gas alternatives from other productive uses and the risk of emissions associated with creation of new or expansion of existing sources of natural gas alternatives.

The preamble to the proposed regulations noted that, for existing biogas or fugitive methane sources that typically productively use or sell a portion of the biogas and flare or vent the remainder, the flared or vented portion may be eligible for first productive use as described earlier if the flaring or venting volume can be adequately demonstrated and verified. The Treasury Department and the IRS requested comment on these and other potential conditions on the use of natural gas alternatives in the production of hydrogen.

After full consideration of the comments and as further explained in this part III.H.2.b. of the Summary of Comments and Explanation of Revisions, these final regulations do not impose a first productive use requirement. Although a first productive use requirement could effectively address important considerations in the determination of a lifecycle GHG emissions rate, the Treasury Department and the IRS acknowledge that the requirement may be difficult for taxpayers to substantiate and to verify independently. Establishing compliance with a first productive use requirement could involve obtaining detailed, often unavailable, historical documentation of the operations of the methane source, including historical production levels, material changes in waste source composition and volume, use of capture equipment and capture rates, sales or uses of captured methane, and waste management practices. Moreover, challenges in the administration of a first productive use requirement raise questions about the practical ability of a first productive use requirement to address the risk of direct or significant indirect emissions effectively. Instead of a first productive use requirement, for determining emission rates associated with the use of methane from natural gas alternatives, the more appropriate approach is to take the likelihood of alternative productive use into account in assessing the alternative fate of such gas, as discussed in part III.H.2.c. of this Summary of Comments and Explanation of Revisions.

The Treasury Department and the IRS received many comments addressing the first productive use requirement. Many comments questioned the legal and technical basis of a first productive use requirement. Several comments asserted that a first productive use requirement is not authorized by statute, overly restricts otherwise eligible biogas and RNG feedstocks that could support clean hydrogen production and ignores the fact that there are numerous reasons an existing biogas facility may switch productive uses, including, but not limited to, the expiration of existing contracts, like power purchase agreements. Other comments asserted that there is no evidence that RNG-to-hydrogen pathways will result in the induced emissions that appear to underlie the first productive use requirement and that such emissions are not included in the 45VH2–GREET model, which the comments asserted is the only basis allowed for assessing lifecycle GHG emissions.

One comment contended that industry data suggests that domestic production of biogas and RNG can support both new hydrogen production and current end uses like compressed natural gas (CNG) transportation vehicles; thus, within the timeframe that section 45V credit will be available, there is ample capacity to serve demand in many sectors, without causing induced emissions. Similarly, several comments stated that much of the RNG produced in the United States is used in the transportation sector for compliance with the RFS and/or State clean fuel programs like the CA LCFS. These comments explain that since these programs drive deployment of a specific amount of compliant fuels, if an existing RNG supplier leaves these transportation markets to supply RNG as a feedstock to a new hydrogen production facility, the prior end use of such RNG will be backfilled with other compliant fuels (for example, those that meet the RFS's GHG requirements).

In response to these comments, the Treasury Department and the IRS acknowledge that these existing transportation fuel programs, chiefly the RFS and the CA LCFS, have been the primary drivers for deployment of RNG

domestically. The Treasury Department and the IRS agree that the existence of these programs mitigates the risk that RNG currently produced for such programs will be redirected to hydrogen production, although there could be incentives for such use if any such hydrogen could itself qualify to claim credits under these programs. Despite this, there still remains a risk that RNG (or biogas) could be redirected to hydrogen production from other current uses, such as heat and power generation. Additionally, because RNG currently comprises the vast majority of cellulosic biofuel credits generated under the RFS program, it is not necessarily the case that RNG previously used in this program would be backfilled with other compliant fuels should insufficient RNG be available for use as U.S. transportation fuel. As discussed previously, however, these final regulations do not impose a first productive use requirement at this time, but instead take an alternate approach to addressing these concerns.

One comment suggested that the Treasury Department could adopt a mid-program ''check-in'' to evaluate whether clean hydrogen produced using RNG is leading to unintended increases in emissions. Facilities that have achieved commercial operation during this period could qualify as ''additional'' for purposes of tax credit eligibility. Moreover, any biogas sources that are newly converted from electricity generation to RNG production should be credit-eligible regardless of whether the agency adopts the proposed ''first productive use'' requirement. Several comments suggested that a robust assessment of any induced emissions associated with redirecting RNG from its prior use to hydrogen production would demonstrate that such consideration would not result in an increase in the emissions rate and, therefore, such emissions need not be considered due to the speculative nature of the initial premise. Some comments noted that a potential alternative would be to add an indirect emission charge equal to the emissions associated with the extraction, processing, and delivery of fossil natural gas to backfill the prior demand for such gas. Another comment stated that while the intent of the first productive use requirement is logical, it would be more efficient and cost effective to assign production values to the RNG inputs used in hydrogen production because this would allow hydrogen producers to factor output costs given the RNG feedstocks used to create the hydrogen they offer to the marketplace. Several comments stated that fugitive methane should not be considered incremental if such methane comes from the fossil fuel system, as this is already accounted for under the current GREET model.

In response to these comments, the Treasury Department and the IRS acknowledge that the first productive use requirement, which is not required as part of these final regulations due to the difficulties in proving and verifying first productive use, would address two aspects of lifecycle GHG emissions assessments, both of which must be considered under section 45V(c)(1)(A). First, a first productive use requirement would mitigate the risk of emissions associated with the diversion of natural gas alternatives from a productive use other than the production of hydrogen. Although methane from natural gas alternatives could be used for different productive uses, the potential emissions associated with changes in use are nonetheless relevant in the determination of a lifecycle GHG emissions rate. Second, a first productive use requirement aids in the determination of the appropriate alternative fate of natural gas alternatives used in the production of hydrogen. Comments questioning a first productive use requirement because of a lack of evidence of induced emissions arising from shifts in behavior due to the availability of the section 45V credit are not dispositive. Section 45V(c)(1)(A) does not require empirical evidence of direct and significant indirect emissions associated with a newly available incentive like the section 45V credit before the likelihood of such emissions may be considered, and such a restriction would systematically underestimate such emissions. As further explained below, it is necessary for a lifecycle GHG emissions assessment that is consistent with the statutory definition of lifecycle emissions in 45V(c)(1)(A) to reflect the emissions effects that can be reasonably expected to occur based on current or future market trends and drivers, inclusive of incentives and regulation.

Some comments suggested that a first productive use requirement should not be imposed for purposes of the section 45V credit because there already exist established frameworks for other incentive programs involving methane from natural gas alternatives, which may be relied upon to determine lifecycle GHG emissions. One comment stated that producers should be allowed to use the emissions data collection methods and book-and-claim framework that have been established under the RFS program to incorporate Renewable Identification Numbers (RINs) in the natural gas supply chain and demonstrate CO2 reduction. Another comment asserted that the first productive use rule must be eliminated because RNG is already regulated under the RFS program, which should continue to serve as the regulatory authority for RNG. In response to these comments, the Treasury Department and the IRS note that the RFS program does not regulate the use of RNG. Rather, the RFS program allows RNG used as transportation fuel to generate RINs under certain conditions. The Treasury Department and the IRS acknowledge that programs such as the RFS program have considered and established frameworks for addressing issues relevant to the implementation of section 45V, but section 45V has its own statutory requirements that diverge from those of other programs.

Key distinguishing features include the structures of these incentive programs, which influence how lifecycle analysis is conducted. The RFS program, for example, determines credit values based on whether a given renewable fuel achieves a threshold reduction of GHG emissions relative to petroleum, where the threshold is defined by the statute that enacted the RFS program. For this reason, the RFS program is not designed to estimate specific lifecycle GHG emissions values, which is statutorily required to determine eligibility for and the amount of the section 45V credit. In addition, section 45V requires that emissions be accounted for on a well-to-gate basis (versus the well-to-wheel basis for the RFS program), and the statute does not permit accounting for the emissions of the fuel being displaced by hydrogen use. These final regulations, therefore, do not adopt any of those frameworks for other incentive programs involving methane.

Many comments raised concerns about the effect a first productive use requirement would have on deployment of hydrogen production technologies that rely on natural gas alternatives and suggested it could also have other undesirable effects on the market for certain methane sources. Several comments suggested the first productive use rule limits RNG pathways by creating a de facto strict additionality requirement that is even more onerous than that proposed for electricity and EACs. Several comments suggested the first productive use rule should be eliminated to incentivize raw biogas to be upgraded to RNG, which ensures that harmful air pollutants are not released into the atmosphere by burning raw biogas (as in electricity production from

biogas, for example). Another comment argued a first productive use requirement is not feasible because RNG is delivered through national and interstate common carrier pipelines from multiple sources. One comment stated that the first productive use requirement is overly burdensome and will unnecessarily restrict opportunities to decarbonize hydrogen production as well as curtail methane abatement at scale. Several comments contended that the proposed ''first productive use'' requirement would cause a significant value discrepancy for new projects creating a market distortion, greater risk of stranded gas for existing projects, added complexity, and higher prices for end-consumers. Several comments cautioned that adding a first productive use rule creates potential unintended consequences of RNG plants sitting idle if hydrogen production facilities do not coincide with the RNG plant completion dates. One comment noted that one possible scenario is if a hydrogen production facility is initially conservatively sized and cannot use the full amount of RNG being produced at a specific project until a later date, the excess RNG would either sit idle so as to not trigger a first productive use or would have to enter less lucrative markets, which could put the project in jeopardy. Another comment stated that there are limited options for large-scale RNG production in certain areas and that requiring a hydrogen production facility to be the first productive use of a RNG facility, and have a pipeline connection, presents a significant logistical barrier to the development of a clean hydrogen project in certain areas. One comment asserted that the proposed first productive use requirement would effectively prevent section 45V credit eligibility for hydrogen projects using RNG. The comment noted that even if a project uses RNG in a low- to no-carbon way, if that RNG was previously used productively or sold at any time, the proposed rules imply that it could not be used in a project that would result in a lower carbon intensity.

Assuming the implementation of the first productive use requirement, many comments requested modifications, changes to, or transitional relief to the first productive use requirement outlined in the preamble to the proposed regulations. One comment suggested that the first productive use rule may be overly restrictive and that it could be beneficial to relax the first productive use requirement, so long as the new use of the RNG delivers overall lower net emissions than its original fate. Another comment suggested that if the first productive use requirement is not eliminated, then a legacy reliance rule and a transitional period through 2032 should be included in these final regulations. Several comments suggested there should be no restrictions on RNG; however, if the first productive use rule is implemented, then it should apply a look-back period of 36 months, not by taxable year but by when the hydrogen is produced. Another comment argued that there should not be a default fossil-based carbon intensity score for RNG that had been productively used before being used to produce hydrogen because doing so fails to recognize the carbon intensity reduction benefit of RNG compared to fossil natural gas that is realized regardless of whether the methane was previously captured and used at the project host. One comment requested that ''first productive use'' be defined as RNG that is produced based on an offtake agreement signed within 48 months of the beginning of hydrogen production, rather than within the same or later taxable year as the relevant hydrogen production facility's placed in service date. Several comments stated the first productive use requirement should be eliminated as it relates to the production of clean hydrogen with coal mine methane. Several comments supported that each individual borehole for coal mine methane be seen as additional and as a first productive use of supply due to each of them being a unique investment decision requiring incremental capital expenditure to mitigate leaking methane. Several comments stated that the definition of first productive use was unclear, and that the definition should focus on ensuring that RNG used for hydrogen is not displacing a previous productive use. One comment argued that ''low-carbon'' gas should also qualify as first productive use if it is from additional methane abatement, even if it is conditioned at a pre-existing facility. In other words, any gas from newly constructed capture infrastructure for fugitive methane, a newly covered lagoon, newly constructed digester, or newly contracted feedstock source for RNG production should count as first productive use, since these are all individual investment decisions that lead to incremental methane abatement. One comment asserted that the presence or use of flaring in appropriate circumstances (for example, safety or compliance with State or local regulations) should not disqualify a facility from eligibility, especially in light of the fact that commercial operations must comply with mandatory but potentially conflicting Federal, State, and local regulatory requirements. Several comments recommended that if the first productive use requirement is adopted, the final regulations should allow existing gas sources to qualify through 2030 to ensure adequate supply. These comments further noted that after 2030 any induced emissions that occurred could be quantified and, if applicable, included in the lifecycle GHG emissions assessment of existing low-carbon gas facilities, as opposed to being grounds for disqualification from the section 45V credit. A comment asserted that if the first productive use requirement is adopted, it must be applied to each methane source—that is, at the digester or lagoon-level for RNG and borehole-level for coal mine methane—so as to reflect how investment decisions are made. Once a low-carbon gas source is accepted as meeting a first productive use requirement (if adopted) under the program, it should not be exclusively tied to a particular hydrogen production facility, according to the comments.

As explained in part III.H.2.c. of this Summary of Comments and Explanation of Revisions, these final regulations are taking into account the lack of a first productive use requirement in the development of alternative fates for certain sources of natural gas alternative, so modifications, changes to, and transitional relief are not necessary. The Treasury Department and the IRS will continue to consider these recommendations raised by these comments in evaluating whether imposing a first productive use requirement, with potential modifications, may be appropriate in future guidance under section 45V.

Many comments supported imposing a first productive use requirement. One comment stated that the proposed first productive use rule would help direct biomethane that is otherwise vented (or, in some cases, flared) to hydrogen production, rather than creating an additional demand for methane by taking from other sources that may meet that demand through dirtier sources of energy. According to the comment, a first productive use requirement is important to avoid significant indirect emissions associated with hydrogen produced from biomethane. The comment noted that avoiding significant indirect emissions is especially important for agricultural methane emissions, which have risen over the last few decades despite overall declines in national methane emissions. Several comments supported the proposed regulations and argued that enforcing

the first productive use rule and narrowly tailoring the definition of first productive use are critical to prevent the significant amount of RNG production today shifting to producing ostensibly clean hydrogen. The comments posited that diversion of currently produced and used RNG to hydrogen production would be backfilled with fossil natural gas and contended this is especially true for existing RNG heat applications and CNG powered vehicles. Thus, any existing RNG diverted to hydrogen production would be filled on a one-for-one basis with fossil natural gas. One comment stated that the proposed rule requiring the first productive use be matched to the same taxable year as (or after) the hydrogen production facility is placed in service would help to limit any diversion of biogas or RNG from other pre-existing uses, which might otherwise increase overall emissions. One comment stated that the first productive use rule is logically consistent with incrementality requirements imposed for EACs representing electricity generation to be considered qualifying. Several comments supported prohibiting crediting of biomethane or fugitive methane that has previously been put to productive use and stated that a first productive use requirement would ensure emissions reductions claimed under section 45V are indeed additional to the climate system overall. The Treasury Department and the IRS agree with many of the observations made in these comments. While these final regulations do not adopt a first productive use requirement for the reasons stated earlier in this Summary of Comments and Explanation of Revisions, the Treasury Department and the IRS have considered these observations regarding alternative productive use of natural gas alternatives when establishing the alternative fates.

c. Alternative Fates

These final regulations establish general requirements for lifecycle GHG emissions determinations for processes that use methane derived from natural gas alternatives to produce hydrogen, requiring such determinations to consider the alternative fates of that methane, including avoided emissions and alternative productive uses of that methane, the risk that the availability of section 45V credits creates incentives to produce additional methane or otherwise induces additional emissions, and observable trends and anticipated changes in waste management and disposal practices over time as they are applicable to methane generation and uses. The emissions risks that would have been addressed by a first productive use requirement are addressed in the development of the appropriate alternative fates for certain sources of natural gas alternatives, thereby reflecting an accurate assessment of lifecycle GHG emissions pursuant to section 45V(c)(1)(A). The factors considered in establishing the appropriate alternative fate are interrelated and must account for other aspects of these final regulations. For example, because these final regulations do not impose a first productive use requirement, there may be a greater likelihood that the appropriate alternative fate for certain sources of natural gas alternatives should be productive use.

As discussed previously, analytical decisions regarding the alternative fate of natural gas alternatives are critical in the assessment of their carbon intensity. Comments suggested a range of broadly applicable alternative fate assumptions for methane from natural gas alternatives used in hydrogen production. Recommendations included venting, flaring, productive use, and responsible avoidance of waste-stream-generated methane.

Rather than adopting a single alternative fate for all natural gas alternatives, these final regulations instead address specific considerations for each major source of natural gas alternatives. This part III.H.2.c of this Summary of Comments and Explanation of Revisions addresses comments recommending broadly applicable alternative fates, while comments addressing alternative fates for specific sources of methane are discussed in parts III.H.2.c.i through vi of this Summary of Comments and Explanation of Revisions.

Comments supported and opposed a venting alternative fate (that is, assuming the methane in question would have been released directly to the atmosphere rather than flared or productively used) for a range of reasons. One comment recommended that avoided emissions crediting should be allowable for fugitive methane feedstocks. The comment stated that, in most instances, alternative fates are not necessary as these are not hypothetical emissions, but measurable real-world fugitives and valuing abatement is straightforward. The comment posited that if a base case is needed, it should be venting or uncontrolled release of 100 percent of the methane potential of the feedstock to the atmosphere. Several comments recommended that biomethane should not receive a negative carbon intensity score by claiming a ''business-as-usual case'' of venting methane. The comments suggested that, at the most generous, this methane should be considered to be captured and flared, which would make the use of this methane for hydrogen production—with the waste stream of carbon dioxide—receive at best a carbon intensity score of zero. One comment stated that there is ample evidence that pre-IRA policies already support the capture of vented methane where possible, for both RNG and fossil gas, and that remaining methane emissions are likely to be mitigated even in the absence of hydrogen projects supported by the section 45V credit. The comment further suggested that allowance of venting as an alternative fate for the purposes of calculating net hydrogen carbon intensity would incentivize hydrogen producers to claim offsets based on an inaccurate assumed alternative fate against real emissions from production and upstream methane leakage in order to establish eligibility for the most generous section 45V credit tier. As a result, the comment recommended that requiring flaring be used as the baseline condition for all pathways including RNG is a simple way to prevent crediting of pathways with GHG reductions based on unrealistic alternative fate scenarios. Several comments stated that venting is not an appropriate alternative fate assumption for biomethane because it is an irresponsible practice and would result in the greatest credit value with respect to gas producers who are investing the least in the environmental quality and emissions reduction technologies at their facilities. Several comments stated that lifecycle analysis should be used to compare the overall environmental impacts of using biogas and fugitive emissions for hydrogen production versus current flaring practices; alternative fates assumptions should be updated to reflect the given tax year's regulatory requirements so, for example, if venting is prohibited, then it is no longer a valid alternative fate scenario.

A number of comments recommended that capture and flaring would be an appropriate alternative fate for certain sources of natural gas alternatives, such as methane from landfills and wastewater treatment plants.

Several comments suggested using conservative assumptions, alternative fates and formulas, and allowing taxpayers to propose and prove alternatives. Many comments requested the adoption of conservative approaches to determining alternative fates. Several comments recommended that any methane that can be captured should, at

minimum, be assigned a baseline alternative fate of being captured and flared. One reason provided by the comments was that flaring appropriately reflects a consistent treatment of pollution sources, recognizing the cost of methane pollution and thus the need for methane abatement.

In response to these comments, the Treasury Department and the IRS agree that venting is not an appropriate alternative fate to apply across all sources of natural gas alternatives, because it does not account for the prevalence of flaring and productive use, nor does it address the risk of induced emissions due to the incentives provided by the section 45V credit. The Treasury Department and the IRS also anticipate that a venting baseline would become increasingly inappropriate over time, due to anticipated changes in regulations and operational practices. The section 45V credit is in effect for facilities beginning construction through 2032 and remains available for a 10-year period after the hydrogen production facility is originally placed in service. The final regulations also generally allow taxpayers to rely for the duration of a hydrogen production facility's 10-year credit period on the version of the 45VH2–GREET model that is available on the date the facility began construction, as is further discussed in part III.B of the Summary of Comments and Explanation of Revisions. Therefore, the final regulations provide that the lifecycle GHG emissions rate of a process (as defined in § 1.45V–1(a)(11)) that uses methane derived from biogas, RNG, or coal mine methane as a feedstock molecule to produce hydrogen, must take into account anticipated changes in waste disposal practices or use of that methane over the relevant timeframe.

In the case of venting, the Treasury Department and the IRS expect venting prohibitions to expand in future years, as local, State, and Federal policy restrictions on venting are becoming increasingly common.

While the policy landscape for specific methane sources is discussed in parts III.H.2.c.i. through vi. of this Summary of Comments and Explanation of Revisions, a range of current and prospective State policies limiting venting of different RNG sources or encouraging more responsible methane management practices indicates the trajectory of State action in this area. For example, California, Colorado, Maryland, Michigan, Oregon, and Washington have all recently taken or imminently plan to take action to restrict venting and require more responsible methane management practices, in some cases beyond the Federal standards currently in place.

As discussed in more detail regarding the specific sources of natural gas alternatives, there are also significant voluntary Federal incentives to encourage responsible methane management practices. There is also evidence of ongoing growth in methane capture through proliferation of landfill gas capture and anaerobic digesters. For example, as shown in updated project database files from EPA's Landfill Methane Outreach Program (LMOP), as of September 2024 there were 1,245 landfills with operational gas collection and control systems, as compared to 1,187 in 2014.[41] Additionally, LMOP data shows growth in the number of landfill gas energy projects upgrading landfill gas to RNG. As of September 2024, there are 110 operational RNG projects (as compared to 63 projects in 2019) and 102 planned or under construction.[42] In addition, as subsequently discussed in this Summary of Comments and Explanation of Revisions, there has been rapid growth in the construction of animal waste digesters, largely as a result of policy incentives, with data from AgSTAR showing an additional 172 operational anaerobic digesters accepting livestock manure in 2024 relative to 2019 (267 digesters).[43] AgSTAR data also demonstrates rapid growth in RNG projects (including pipeline injection and CNG for vehicle fuel or other uses), with 191 RNG projects in 2024 compared to 32 in 2019, and only 8 in 2017.[44] As of 2023, CNG has surpassed Combined Heat and Power (CHP) as the most common end use of biogas from manure-based anaerobic digestion systems in AgSTAR.[45] In light of all these trends, a methane venting baseline across all natural gas alternatives is inaccurate today, and, over time, the assumptions and inputs will likely become increasingly erroneous as regulations, markets, and resource management practices evolve during the period over which the section 45V credit is available. This supports the use of reasonably conservative alternative fates in the face of uncertainty to provide greater assurance that statutory emissions thresholds provided in section 45V(b)(2) will not be exceeded, as described in more detail subsequently in this Summary of Comments and Explanation of Revisions.

The Treasury Department and the IRS also agree that conservative approaches to assessing alternative fates of natural gas alternatives may be an appropriate response to challenges in documenting and verifying alternative fates applicable to specific sources of natural gas alternatives in order to better ensure compliance with the statutory emissions thresholds in section 45V. However, such conservative approaches should consider the distinct characteristics of each source or type of source, to the extent reasonably practicable. Thus, although a capturing and flaring alternative fate may be generally appropriate for some categories of sources of natural gas alternatives, it is not appropriate for all sources of natural gas alternatives.

Some comments suggested that the alternative fate assumption for all methane derived from waste streams should be alternative productive use. One comment recommended that an alternative fate approach should address the risk of indirect emissions by taking into account the alternative fate and the emissions associated with replacing this fate. The comment further suggested that if the hydrogen producer has data and evidence of the alternative fate, for example from the RNG supplier, this should always be used in the first instance, in preference to a market or average assumption provided by the DOE. In addition, the comment stated that venting may be the appropriate alternative fate in some instances, but that it is unlikely to be the appropriate primary alternative fate due to the adverse effects RNG venting has on the climate. The Treasury Department and the IRS note that the recommendations in these comments would significantly increase the complexity in estimating lifecycle GHG emissions associated with the use of natural gas alternatives in the production of hydrogen. Permitting taxpayers to apply bespoke alternative fates for each source of natural gas alternative would increase the burden on taxpayers and on tax administration because substantiation and verification of such bespoke alternative fates would be challenging. As further explained later in this Summary of Comments and Explanation of Revisions, the significant and in some cases growing rates of productive use of methane from certain waste streams is an important consideration in establishing alternative fate assumptions for estimating lifecycle

[41] LMOP Landfill and Project Database, U.S. Environmental Protection Agency, *available at https://www.epa.gov/lmop/lmop-landfill-and-project-database* (last updated Sept. 20, 2024).

[42] *Id.*

[43] *AgSTAR Data and Trends, Biogas Data and Trends,* U.S. Environmental Protection Agency, available at *https://www.epa.gov/agstar/agstar-data-and-trends#biogasfacts* (last updated Nov. 27, 2024).

[44] *Id.*

[45] *Id.*

GHG emissions rates. Because not all methane from waste streams is used productively, however, the comment's suggested assumption that the alternative fate assumption for all methane derived from waste streams should be alternative productive use would understate the potential emissions benefits of using such gas in hydrogen production. The final regulations, therefore, do not adopt these comments.

Some comments suggested that the alternative fate assumption for all waste stream-generated methane should be responsible avoidance of such methane production by applying practices that minimize its production. These comments highlighted the risk that incentives created by the section 45V credit would lead to the production of more, new methane than would have otherwise occurred. The Treasury Department and the IRS agree that this is an important consideration.

For new methane that would not have been produced in the absence of the section 45V credit, use of such methane for hydrogen production must not be reflected as avoided methane emissions in the lifecycle GHG emissions assessment. For certain waste streams, the volumes of waste-stream-generated methane produced by a certain practice can be affected by operator actions, such as a change in manure management practices from land disposal to lagoon disposal, or heating an anaerobic digester to increase the amount of methane produced. Moreover, in some cases, the cost of generating additional methane may be small compared to the value of the section 45V credit. Several comments asserted that fugitive methane and methane from animal lagoon-based manure are both examples of avoidable waste streams that exist solely because of discretionary industry practices; as a result, these comments asserted that methane streams are always GHG positive. Comments asserted that treating this methane consistent with fossil natural gas is a generous approach because biomethane production is associated with higher methane leakage rates. One comment stated that allowing previously flared or vented biogas to be considered as ''incremental'' as a first productive use also brings significant emissions risks by encouraging the expansion of facilities' waste methane streams over prior years to qualify that methane waste for hydrogen production in the future. The comment argued that for landfill gas, considering an ''above average'' approach for incrementality when considering a facility that has no established energy project could be one way of encouraging investment in greater capture rates.

As these comments note, the availability of the section 45V credit may lead to generation of methane in the form of natural gas alternatives for the purpose of producing qualified clean hydrogen that is eligible for the section 45V credit. In those instances, the appropriate alternative fate is that the methane generated from waste streams, or increments of it, would not have been created in the first place or that it would have remained sequestered. In such scenarios, it would be inappropriate to credit hydrogen production with avoided emissions because the analysis must address methane leakage and combustion emissions that otherwise would not have occurred, and crediting these scenarios with avoided emissions would likely result in providing a section 45V credit for the production of hydrogen that is ineligible for the credit based on the statutory emissions requirements. This is a particularly important consideration for certain types of methane-producing practices and materials and for determining the appropriateness of alternative fates that can result in highly negative lifecycle GHG emissions rate estimates if emissions from additional methane generation are not accounted for, which would create potentially large incentives for additional waste production (potentially resulting in highly inaccurate lifecycle emissions assessments).

In light of the substantial venting and flaring of methane that currently occurs, an alternative fate of avoidance would in many instances understate the emissions benefits of capturing such gas and using it to produce hydrogen. In order to meet statutory requirements, however, incentives for methane creation must be considered in the determination of a lifecycle GHG emissions rate.

It is not possible for the Treasury Department and the IRS to ascertain which specific waste-stream-generated methane would not exist absent the incentives provided by section 45V credit, nor is it possible to precisely estimate the market-mediated emissions of such an incentive effect. In order to ensure that these emissions are not merely ignored, which would not be permissible under the statute, and also that the approach is both administrable and appropriate, after consultation with the DOE, these final regulations take the economic incentives for additional waste production into account in establishing the alternative fates that apply in general to particular feedstocks. Specifically, in settings where a significant but non-identifiable share of methane from some sources could be produced in response to incentives provided by the section 45V credit or other programs, alternative fate assumptions that result in highly negative emissions estimates are likely to be inaccurate and understate the real-world lifecycle GHG emissions. These final regulations require that determinations of alternative fates for methane derived from biogas, RNG, or fugitive methane consider the risk that the availability of tax credits creates incentives to produce additional methane.

i. Alternative Fate Considerations for Methane From Certain Waste Streams

Informed by the considerations discussed earlier, § 1.45V–4(f)(3)(ii) through (vi) specifically addresses the alternative fate considerations for methane from landfill sources, wastewater, coal mine methane, animal waste sources, and fugitive methane other than coal mine methane. The following parts of this Summary of Comments and Explanation of Revisions address these specific types of sources of natural gas alternatives in further detail. These final regulations have developed alternative fates on a sector-by-sector basis because determining and validating alternative fates on an entity-by-entity basis would not be administrable. As discussed earlier, identifying an appropriate alternative fate for specific sources of natural gas alternatives would depend not only on the specific facts and circumstances (for example, whether methane from the source was already being productively used), but would also require an entity-by-entity assessment of the applicability of alternative fate scenarios with many complex factors potentially relevant to that assessment (for example, financial incentives absent the section 45V credit, regulatory considerations, or trends in waste management or disposal practices). It would be highly burdensome for taxpayers to demonstrate, and impractical to confirm as a matter of tax administration, that a specific methane source had certain historic practices and whether in the future that source would have had a certain disposition of relevant materials other than the one that actually occurred. Quantities of methane from an individual source could even have different alternative fates. For example, assuming a situation where, absent tax incentives, a source capturing and using methane would have produced a lesser amount of methane and vented it, the alternative fate for that amount of

methane (venting) would differ dramatically from the alternative fate of the additional methane produced due to the tax incentive (no methane produced or emitted). Moreover, these administrative challenges are even greater for situations where hydrogen producers are seeking to use a book-and-claim system to assign attributes to natural gas alternatives purchased from an intermediary, such as a common carrier pipeline. In such situations, book-and-claim registries would in theory need to verify and track not only the type of natural gas alternative source but also any additional information relevant to assessing the alternative fate of the methane from the specific source. Given these significant administrative challenges, the alternative fates are assessed and applied on a sector-by-sector basis in these final regulations.

ii. Alternative Fate Considerations for Methane from Landfill Gas

The preamble to the proposed regulations recognized a pathway within 45VH2–GREET for determining a lifecycle GHG emissions rate using an alternative fate of flaring for the production of hydrogen using RNG derived from landfill gas. The final regulations continue to recognize a hydrogen production pathway in 45VH2–GREET that applies an alternative fate of flaring in assessing the use of RNG produced from landfill gas in the production of hydrogen.

A number of comments highlighted competing considerations in determining the appropriate alternative fate for methane from landfill gas. One comment stated that venting is the correct alternative fate for landfill gas in some instances, such as jurisdictions without flaring regulations in place. Several comments recommended conservative default parameters paired with alternative fate assumptions that would reflect a high potential of leakage at landfills, given that landfills can generate super-emitting plumes and studies suggest collection efficiency can be overestimated. Several comments noted the 45VH2–GREET model properly includes avoided emissions with respect to landfill gas. The comments state that the RNG industry supports and agrees that any methodology assessing RNG's lifecycle emissions must measure avoided emissions. Several comments proposed that for purposes of calculating the emissions rate for RNG from municipal solid waste landfills, the 45VH2–GREET model must utilize the correct and latest scientific data from the EPA, which the comment asserted shows the national average landfill methane capture rate is 39 percent. However, the EPA data for 2022 shows significantly higher methane recovery rates.[46] Moreover, regulations increasingly require flaring of landfill gas, and, as discussed previously, anticipated changes in regulatory requirements and operational practice are an important consideration in determining appropriate alternative fates.

The EPA currently regulates emissions (in the form of landfill gas using non-methane organic compound (NMOC) emissions as a surrogate) from landfills under section 111 of the Clean Air Act. EPA regulations under the Solid Waste Disposal Act (commonly known as the Resource Conservation and Recovery Act, or RCRA) mandate certain landfill management practices that also affect methane emissions from landfills. As noted elsewhere in this Summary of Comments and Explanation of Revisions, several States have adopted additional more stringent requirements for landfill methane emissions. The EPA has also announced that it intends to update and strengthen its existing landfill regulations under section 111 of the Clean Air Act in 2025.[47] The current rules for landfill gas emissions were finalized in 2016. Pursuant to the EPA's regulatory plan, the EPA plans to revisit the rule to understand how new technologies and approaches could be incorporated into updated New Source Performance Standards (NSPS) and Emissions Guidelines to reduce emissions from municipal solid waste landfills and to protect the environment and the health of people that live nearby.[48]

In particular, certain landfills are subject to NSPS (40 CFR part 60, subpart XXX) and Emissions Guidelines (40 CFR part 60, subpart Cf) under section 111 of the Clean Air Act (collectively, NSPS/EG Rules). The listed regulated pollutant under these regulations is ''landfill gas.'' The EPA has also promulgated National Emissions Standards for Hazardous Air Pollutants (40 CFR part 63, subpart AAAA) in 2020 that regulate the emissions of Hazardous Air Pollutants (HAP) from landfills. The NESHAP regulates HAP emissions by requiring landfills that exceed the size and NMOC emission thresholds to install and operate a landfill gas collection and control system (GCCS). As in the NSPS/EG, the GCCS is required to include a control device capable of reducing NMOC emissions by 98 percent. This system will also reduce emissions of methane since methane makes up approximately 50 percent of the landfill gas.

The EPA's current Clean Air Act section 111 NSPS provide emissions control requirements for new (since 2014) municipal solid waste landfills. *See* 40 CFR part 60 subpart WWW and subpart XXX. The section 111 emissions guidelines (EG) cover existing (pre-2014) municipal solid waste landfills through requirements that are adopted by States through State plans, or by the EPA in the event a State does not submit an approvable plan. *See* 40 CFR part 60 subpart Cf. Both new and existing landfills that exceed specified size and emissions thresholds must install landfill gas GCCS and use, sell, or flare (combust) the gas. The EPA estimated that 846 landfills would be required to collect and control landfill gas under these regulations by 2025.[49] In addition, landfills covered by these regulations and that have GCCS installed must conduct quarterly surface monitoring for leaks. In the States with more stringent State requirements, the requirements commonly apply to smaller landfills, landfills with lower emissions levels, and/or apply more stringent emissions control measures compared to the Federal requirements. A number of other landfills that are not subject to emissions control regulations nevertheless have installed landfill GCCS and are either flaring, combusting the gas for energy generation, or upgrading it and injecting it in the

[46] U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022* (2024), at 725, available at *https://www.epa.gov/system/files/documents/2024-04/us-ghg-inventory-2024-main-text_04-18-2024.pdf.*

[47] *Non-regulatory Public Docket: Municipal Solid Waste Landfills,* U.S. Environmental Protection Agency, available at *https://www.epa.gov/stationary-sources-air-pollution/non-regulatory-public-docket-municipal-solid-waste-landfills* (last updated Dec. 9, 2024); Press Release, The White House, *Fact Sheet: Biden-Harris Administration Announces New Actions to Detect and Reduce Climate Super Pollutants* (Jul. 23, 2024), available at *https://www.whitehouse.gov/briefing-room/statements-releases/2024/07/23/fact-sheet-biden-harris-administration-announces-new-actions-to-detect-and-reduce-climate-super-pollutants;* Keaton Peters, *Is the EPA About to get Serious About Methane Pollution from Landfills?,* Canary Media (Jul. 10, 2024), available at *https://www.canarymedia.com/articles/methane/is-the-epa-about-to-get-serious-about-methane-pollution-from-landfills.*

[48] Reconsideration of Standards of Performance and Emissions Guidelines for Municipal Solid Waste Landfills (RIN 2060–AU24) available at *https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=202404&RIN=2060-AU24.*

[49] U.S. Environmental Protection Agency, *Final Updates to Performance Standards for New, Modified and Reconstructed Landfills, and Updated to Emission Guidelines for Existing Landfills: Fact Sheet* (Sept. 2016), available at *https://www.epa.gov/sites/default/files/2016-09/documents/landfills-final-nsps-eg-factsheet.pdf.*

pipeline system for sale.[50] The LMOP tracks voluntary GCCS installation based on available data reported by program partners. As of 2024, at least 450 landfills operate a GCCS without being required by regulation. Many of the landfills that are not currently regulated or voluntarily collecting gas may be required to collect and control landfill gas emissions during the timeframe in which the section 45V credit is available, as additional regulation is expected at both the Federal and State level.[51]

Given that landfill gas collection and use or flaring is widespread, as it is required by regulation for an increasing number of landfills and often supported by GHG credit programs when not required, an assumption that absent the section 45V credit the typical practice would be uncontrolled venting is not supportable. Although landfill gas is increasingly put to productive use, and there are some landfills where capture and flaring or productive use is not yet occurring, since collection and flaring is required by law for the largest sources of landfill gas and is increasingly being required for smaller sources as well, collection and flaring is the most appropriate alternative fate assumption for the sector as a whole given its prevalence. Although a flaring alternative fate will result in an underestimate of lifecycle GHG emissions for landfills with current productive use, the fact that there are some landfills where capture and flaring or productive use is not yet occurring, in combination with the prevalence of flaring, makes a flaring alternative fate the most robust approach for the sector as a whole. Based on all the considerations noted previously, § 1.45V–4(f)(3)(ii) of the final regulations provides that, for purposes of determining the lifecycle greenhouse gas emissions rate of a process (as defined § 1.45V–1(a)(11)) that uses methane derived from landfill sources, flaring of such gas using an efficiency determined in 45VH2–GREET must be used as the alternative fate. Flaring efficiency is specified as background data in 45VH2–GREET because bespoke values are likely to be unavailable or inaccurate, since it is not common practice to measure the flare gas chemical composition or to have continuous monitoring of flares at landfills.

iii. Alternative Fate Considerations for Methane From Wastewater

The proposed regulations did not recognize a pathway for determining a lifecycle GHG emissions rate for the production of hydrogen using methane produced from wastewater, but the preamble to the proposed regulations sought comment on the treatment of various sources of RNG. These final regulations support providing a pathway in 45VH2–GREET to determine the lifecycle GHG emissions rate for the production of hydrogen that applies a flaring alternative fate for biogas and related RNG from wastewater sources in concert with default wastewater treatment practices defined in the forthcoming, January 2025 version of 45VH2–GREET and described in this part III.H.2.c.ii of these Summary of Comments and Explanation of Revisions.

Several comments stated that it would be incorrect to presume that most wastewater treatment plants have operational biogas/anaerobic digester systems and that operational biogas systems are flaring their gas. At least one comment asserted that, based on the American Biogas Council's database of wastewater facilities maintained under a memorandum of understanding with the Water Environment Federation, the vast majority of operational digester systems at wastewater plants are using such biogas to produce renewable electricity, RNG, or heat, which, according to the comment, offsets fossil fuel use and its related emissions. Another comment opposed a venting baseline for instances like wastewater treatment on the basis there is no administrable system that credibly enables producers to distinguish the gas that would be vented if not for the existence of the section 45V credit.

National-level data on anaerobic digestion at wastewater treatment plants and the use of biogas produced is limited. There are more than 16,000 wastewater treatment plants in the U.S. While most wastewater treatment plants in the U.S. serve small populations and do not process sufficiently large wastewater flows to justify the installation of anaerobic digesters, which are capital-intensive, anaerobic digesters are very prevalent among the smaller number of large wastewater treatment facilities that process the large majority of wastewater: the largest 8 percent of facilities (1,132 facilities that each handle greater than 5 million gallons per day) process 77 percent of total national wastewater flow, according to Argonne National Laboratory. Among the 1,100 generally large wastewater treatment plants that have anaerobic digesters, 860 have the equipment to use their biogas on site, according to the DOE's Alternative Fuels Data Center. Additionally, nearly all biogas-producing wastewater treatment plants surveyed in 2018 reported flaring at least some of their biogas, based on the Nationwide Survey of WRRF Biosolids Programs released in 2022. Venting practices are not reported in any national datasets, although vents are required to prevent overpressurization events in biogas storage systems and local regulators may require facilities to track and report venting events. Some facilities combust biogas to heat their digesters and some also take advantage of the additional heat availability for use in on-site biosolids drying.

Given that use or flaring of methane from wastewater is generally applied to the majority of wastewater generated domestically, an assumption that absent the section 45V credit the typical practice would be uncontrolled venting is not supportable. Section 1.45V–4(f)(3)(i) of the final regulations therefore provides that, for purposes of determining the lifecycle greenhouse gas emissions rate of a process (as defined § 1.45V–1(a)(11)) that uses methane derived from wastewater sources, the alternative fate of such gas must assume flaring and use the flaring efficiency and other factors as determined by 45VH2–GREET, including accounting for the proportion of the gas typically used to heat the anaerobic digester.

For the large majority of biogas from wastewater treatment plants, this is either consistent with current practice, or modestly overestimates avoided emissions in cases where the portion of biogas not needed to satisfy on-site heat requirements would otherwise have been productively used. Although a flaring alternative fate for this additional biogas will result in an over-estimate of avoided lifecycle GHG emissions for wastewater treatment plans with current productive use beyond satisfying on-site heat demands, this potential overestimation of GHG emissions avoidance is counterbalanced by the existence of wastewater treatment plants where capture and flaring or productive use is not yet occurring, thus making default wastewater treatment practices the most appropriate approach for the sector as a whole.

[50] *Landfill Methane Outreach Program (LMOP),* U.S. Environmental Protection Agency, available at *https://www.epa.gov/lmop* (last updated Dec. 5, 2024).

[51] In addition to upcoming EPA regulations, additional states are also contemplating regulations. *See, for example, Landfill Methane Reductions in Colorado,* Colorado Department of Public Health and Environment, available at *https://cdphe.colorado.gov/landfill-methane-reductions-in-colorado;* New York Department of Environmental Conservation et al., *Methane Reduction Plan* (May 2017), available at *https://extapps.dec.ny.gov/docs/administration_pdf/mrpfinal.pdf.*

iv. Alternative Fate Considerations for Coal Mine Methane

The proposed regulations did not recognize a pathway within 45VH2–GREET for determining lifecycle GHG emissions rates for the production of hydrogen using coal mine methane (CMM), but the preamble to the proposed regulations invited comment on the treatment of various sources of fugitive methane. The final regulations support providing a pathway in 45VH2–GREET to determine the lifecycle GHG emissions rate for the production of hydrogen that applies a flaring alternative fate for CMM.

The Treasury Department and the IRS recognize that fossil sources of fugitive methane can be utilized for hydrogen production. Many comments specifically noted the feasibility of transforming CMM into hydrogen and identified venting as a common alternative fate. One comment noted concerns associated with allowing for the use of fugitive methane from sources such as coal mines until robust lifecycle analysis, verifiability, incrementality, and other principles related to the emissions impacts of this gas are demonstrated.

The DOE has advised that drainage gas is the subset of CMM that can be used for hydrogen production, due to its high methane content. Drainage systems are a mechanism of recovering methane from underground mines to maintain safe operating conditions.[52] These systems are typically installed when ventilation systems are insufficient to maintain underground methane concentrations within permissible limits. Unlike drainage gas, ventilation gas is typically dilute in methane content and therefore cannot be used for hydrogen production.

Based on consultation with the DOE and the EPA, the Treasury Department and the IRS understand that the EPA's GHGRP is the only national public database with historical information provided annually by large active underground mines regarding their treatment of drainage gas. Review of data submitted by coal mines to GHGRP under section 98.326 of Subpart FF indicates that, while the majority of ventilation gas liberated by coal mines over the past decade has been vented, the majority of drainage gas has been productively used or flared. Mine practices have fluctuated, with some mines transitioning from predominantly venting drainage gas to predominantly using or destroying such gas. Factors that can affect the extent to which a mine vents, flares, and/or productively uses such gas in a given year include the amount of methane required by onsite equipment (for example, engines); proximity to offsite infrastructure (for example, pipelines); and the lucrativeness of programs incentivizing the capture of CMM. Incentives for CMM destruction and utilization that are currently available include State offset programs, State renewable portfolio standards, and voluntary offsets, some of which specifically do not allow for pipeline injection.

The DOE and the EPA have advised that there is considerable uncertainty associated with establishing the appropriate alternative fate scenarios for CMM for the 10-year duration over which a hydrogen production facility may be able to claim the section 45V credit. Coal mines that are currently injecting CMM into pipelines may transition to flaring if natural gas prices fall or may exercise flaring at future boreholes if those boreholes are distant from existing pipeline infrastructure. Mines that are currently predominantly venting may transition to productive use if pipeline infrastructure is built in their vicinity. A flaring baseline is therefore the most appropriate approach for CMM given the uncertainty with respect to these emissions and because it reduces the risk of inappropriately attributing extremely negative lifecycle emissions rates to the capture of CMM which would have already been captured and productively used.

Accordingly, § 1.45V–4(f)(3)(iv) of these final regulations provides that for purposes of determining the lifecycle GHG emissions rate of a process (as defined § 1.45V–1(a)(11)) that uses coal mine methane, flaring of such gas must be used as the alternative fate. This alternative fate accounts for the uncertainties associated with future practices, as described above, while recognizing that most drainage gas is destroyed today.

v. Alternative Fate Considerations for Animal Waste

The proposed regulations did not recognize a pathway to determine lifecycle GHG emissions rates for hydrogen production processes that use RNG produced from biogas from animal waste and invited comment on the treatment of various sources of RNG. The final regulations support providing a pathway in 45VH2–GREET to determine the lifecycle GHG emissions rate for the production of hydrogen that applies an alternative fate derived from the national average of current animal waste management practices.

Comments suggested a variety of alternative fate assumptions for purposes of estimating lifecycle greenhouse gas emissions for these sources of RNG, including venting, alternative productive use, and responsible waste management, with some comments recommending a single alternative fate for RNG produced from these sources and others recommending differentiated alternative fates. There is no national database that tracks farm-level methane emissions, capture, and usage in the agricultural sector. Additionally, there are no nationally applicable reporting requirements for animal waste management practices at livestock and poultry farms, which differ substantially on a farm-to-farm basis, and state-level reporting animal waste management reporting requirements vary. Therefore, lack of data and heterogeneity of animal waste management practices are limiting factors in establishing a single specific alternative fate for methane generated from animal waste.

Many comments highlighted competing considerations in determining the appropriate alternative fate for methane derived from animal waste. Several comments recommended the 45VH2–GREET model calculate the avoided emissions from anerobic digestion and the associated RNG project using site-specific baseline manure management practices. The comments suggested the model could be modified to offer a menu that enables the user to identify what fraction of the manure was handled using each of these pre-project practices. The comments noted that each RNG project's emissions reduction benefit may vary significantly based on the pre-existing manure management practices, and therefore it is crucial to have a drop-down selection in order to accurately calculate the lifecycle GHG emissions. Several comments suggested that for biogas produced from livestock manure, the alternative fate should be that methane would continue venting from manure handling facilities until such time as that venting is no longer permissible by law or regulation. The comments note that this alternative fate is similar to what the comments assert is appropriate for the landfill gas industry, where once regulations are in place that require landfill gas to be captured and destroyed, then flaring becomes the appropriate alternative fate. One comment recommended that a minimum utilization or flare rate of 80 percent of recoverable methane emissions be adopted as the basis in the

[52] Active underground mines that liberate more than 36,500,000 actual cubic feet of methane per year report annually to GHGRP on whether their drainage gas is vented or destroyed.

alternative fate case for determining the carbon intensity of RNG that is utilized in the production of clean hydrogen. One comment noted that although the primary precedent for crediting avoided methane emissions is the CA LCFS's treatment of biomethane from manure lagoons, this precedent serves to illustrate the inappropriateness of its adoption in section 45V. The comment stated that it is widely understood that the avoided methane calculation was specifically incorporated within the LCFS as a means of subsidizing investments in anaerobic digesters to address pollution from California's dairies, not to reduce emissions from transportation fuel. Several comments noted that R&D GREET recognizes avoided emissions benefits in its lifecycle modeling for RNG where the manure and other wastes would otherwise release GHGs into the atmosphere. The comments state that the RNG industry agrees that any methodology assessing RNG's lifecycle emissions must measure avoided emissions.

Determining the appropriate alternative fate and emissions intensity for RNG produced from animal waste sources presents several challenges. First, the emissions intensity of biogas and ensuing RNG produced from animal waste can vary widely based on the specific waste practices used by individual producers. These practices are not comprehensively tracked and, in many cases, would be extremely difficult to effectively verify. Different waste disposal practices produce very different quantities of methane per unit of manure, as methane generation is much higher in wet anaerobic conditions. As one example, EPA GHG Inventory data indicates that uncovered anaerobic lagoons produce roughly one hundred times the amount of methane as daily spread. Even among farms credited with methane venting counterfactuals under the CA LCFS, the resulting RNG GHG emissions intensities vary widely depending on specific practices. Factors impacting the emissions intensity calculations for that program include, but are not limited to, the type of animals producing waste for the digester, type(s) of feed provided for the animals, the digester technology, and ambient conditions at the digester. As discussed further below, none of these practices are comprehensively tracked or reported at a national level. Comments also noted the further uncertainty and variation introduced by a range of leakage rates from operations capturing and upgrading manure-derived methane, including the high likelihood that there are ''super emitter'' sources (consistent with the patterns seen in other fugitive methane streams). This could introduce additional uncertainty and risk of over crediting in estimating a GHG emissions rate.

Second, there is substantial and growing alternative productive use of methane from animal waste. There are 400 operational animal waste anaerobic digesters in the U.S. and 73 additional digesters under construction as of 2024, according to the AgSTAR Digester Database. Based on data from the AgSTAR Digester Database on the number of livestock (by head) feeding anaerobic digesters as of 2024, it is estimated that the waste from roughly 8 percent of dairy cattle and 2 percent of swine (by head) is currently sent to anaerobic digesters and these numbers increase to 10 percent and 3 percent, respectively, if digesters currently under construction are included.[53] The percentage of waste being sent to anaerobic digesters has been rising rapidly since 2019, with 400 operational projects and 73 under construction, and with the majority of new projects upgrading their biogas to RNG, due, in part, to incentives provided by the RFS, LCFS, and a California grant program. The digesters listed as newly operational and under construction as of 2023–2024 in the AgSTAR database represent a 28 percent increase in the dairy cattle waste and 50 percent increase in swine waste (by head) sent to anaerobic digesters relative to 2022 levels. While there has been some variation in the profitability of installing anaerobic digesters as credit values have fluctuated,[54] the financial incentives provided by the RFS and LCFS programs appear to be sufficient to incentivize some installations of anaerobic digesters at existing lagoons, which reduces emissions without any additional incentive from the section 45V credit. There are also other possible sources of revenue from anaerobic digester systems including net-metering in the case of electricity generation, tipping fees from local food production, or the sale of secondary products such as digestate-based fertilizer or phosphorus pellets.

Complementing these incentives are a range of other voluntary programs that encourage capture and productive use of methane emissions from animal waste. For example, the United States Department of Agriculture (USDA) is leveraging its authority under a variety of existing programs to encourage farmers and ranchers to install or upgrade equipment and adopt new practices that improve manure management and can substantially reduce methane emissions. One such program, AgSTAR, is a collaborative program sponsored by the EPA and USDA that promotes the use of biogas recovery systems, such as anaerobic digester systems, to reduce methane emissions from animal waste. Likewise, USDA Natural Resources Conservation Service programs—including the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program (CSP)—provide incentives for upgrading existing anaerobic lagoons, anaerobic digesters, and solid separators and covers to collect methane for use or destruction; installing solid separators that reduce methane-producing slurries; and providing conservation assistance for transitions to alternative manure management systems, such as deep pits, composting, transitions to pasture, or other practices that have a lower GHG emissions profile. The Rural Energy for America Program (REAP) has offered more than $160 million in grants and loans to incentivize anaerobic digesters and biogas projects to control methane and biogas from dairy and other farms.

Given rapid recent and continuing growth and multiple existing incentive programs, it is reasonable to assume continued growth in the share of large dairies and confined animal feeding operations with anaerobic digesters, even absent an additional incentive under the section 45V credit. Redirecting biogas and ensuing RNG that comes from these sources to hydrogen production will mean less displacement of natural gas elsewhere in the economy, and could therefore result in significant indirect emissions

[53] Values were calculated using data from the AgSTAR Digester Database. *Livestock Anaerobic Digester Database,* U.S. Environmental Protection Agency, available at *https://www.epa.gov/agstar/livestock-anaerobic-digester-database* (last updated Oct. 1, 2024). The sum of dairy cattle reported as feeding operational digesters in the AgSTAR database as of June 2024 was calculated to be 1.55 million. The sum of swine reported as feeding operational digesters was calculated to be 1.68 million. The total values including digesters that are under construction are 1.87 million dairy cattle and 2.08 million swine. Percentages are calculated by dividing these values by the most up-to-date data on dairy cattle and swine head: total dairy cattle head in 2022 (18.6 million) and swine head (73.4 million) as reported in the EPA GHG Inventory. *See also* U.S. Environmental Protection Agency, ''Inventory of U.S. Greenhouse Gas Emissions and Sinks,'' available at *https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks* (Last updated November 22, 2024).

[54] Aaron Smith, *How Much Should Dairy Farms Get Paid for Trapping Methane?,* Energy Institute at Haas, Energy Institute Blog (Oct. 14, 2024), available at *https://energyathaas.wordpress.com/2024/10/14/how-much-should-dairy-farms-get-paid-for-trapping-methane/.*

that must be taken into account under the section 45V(c)(1)(A) and (B).

Third, the magnitude of the incentive provided by the section 45V credit itself creates a significant risk of additional waste production in response to the credit, with emissions that must be accounted for in the LCA. Additional waste production could result in additional emissions; moreover, even if emissions from additional production are captured, crediting the additional waste with avoided emissions would result in inaccurate credit determinations. For RNG produced from animal waste, there are several potential routes that may increase methane production:

- Shifting management practices for existing quantities of manure from land application to lagoon, thereby significantly increasing methane generation;
- On the margin, making new or expanded concentrated animal feeding operations (CAFOs) more profitable (whether by increasing the overall numbers of animals raised, or by consolidating smaller existing operations) and thereby inducing additional manure and methane generation; and
- Using management practices at biodigesters to produce more methane than would have been produced otherwise (for example, increasing the temperature at an anaerobic digester).

To the extent producers adopt these practices in response to incentives created by the section 45V credit, failure to take this into account could lead to allocating the section 45V credit to hydrogen that does not meet statutory GHG emissions requirements. This would be a particular concern with a venting alternative fate because it would result in a very negative estimated lifecycle GHG emissions rate, creating strong incentives to produce additional methane that is used by hydrogen producers to claim the section 45V credit inappropriately.

In light of these challenges and in consultation with the DOE regarding the most appropriate approach to determining the GHG intensity of biogas and ensuing RNG derived from animal waste, these final regulations use an alternative fate for the sector as a whole that is derived from the national average of all animal waste management practices. The rule provided in § 1.45V–4(f)(3)(v) uses a best estimate of the nationwide average methane emissions from manure based on currently available data. As detailed in a technical analysis from the DOE, this results in a carbon intensity score of −51g of CO2e per megajoule (MJ), where the MJ basis refers to the lower heating value of the methane contained in the biogas prior to upgrading. This emissions attribute for the methane contained in biogas from animal waste can be subsequently used to calculate the carbon intensity of RNG by accounting for the lifecycle GHG emissions associated with the biogas upgrading, transportation, and compressing process.

As further explained in the DOE's analysis of animal waste sources, this carbon intensity of RNG derived from methane contained in biogas from animal waste has been calculated using a weighted average of U.S. manure management practices across manure from all types of livestock and poultry.[55] Averaging over the full set of animal-waste management practices nationwide is an administrable way to take into account the range of existing waste management practices and represent emissions reductions that result from additional methane capture and use. It is a reasonable and administrable representation of the carbon intensity of RNG from manure-based sources in light of the significant limitations of available data and verification mechanisms, the uncertainties associated with estimation of the GHG emissions, the benefits of different manure management systems, and the risks of perverse incentives. At the same time, it provides taxpayers certainty and clarity regarding the carbon intensity of methane from certain animal waste sources.

The Treasury Department and the IRS considered alternative approaches, in particular whether to provide differentiated alternative fates, for example based on a producer's prior waste management practices and methane production levels or the mix of animal types used to generate biogas. Differentiated alternative fates, however, is not feasible because it would not be administrable or practicable to set up a reporting and verification system to determine the prior practices and quantities of manure and biogas at each individual participating livestock and poultry operation that generates and sends biogas to an RNG upgrader. Such an approach would be infeasible given the large number of such operations and the lack of nationally applicable reporting requirements regarding numbers of animals or manure management practices by livestock and poultry operation (and wide variation in State reporting requirements). Additionally, 104 of the 473 digesters operational or under construction in the AgSTAR database report co-digesting their primary manure type with one or more other wastes, including other types of manure, food waste, agricultural residues, and dairy/food processor waste. These tracking and verification challenges are of particular concern because differences in waste disposal practices or specific waste sources can result in large differences in avoided emissions, meaning that highly specific prior waste management practices would need to be consistently reported and verified to support accurate differentiated alternative fates. In addition, as discussed previously, differentiated alternative fates that allow for highly negative emissions values raise concerns about incentives for additional waste production that could result in inappropriate claims of the section 45V credit. The Treasury Department and the IRS, in consultation with the DOE, will continue to monitor reporting and tracking systems and study the feasibility of introducing differentiated pathways in the future.

The Treasury Department and the IRS also considered whether the emissions values for RNG produced from animal waste should be adjusted to reflect the risk of additional waste production in response to the incentives provided by the section 45V credit. While the emissions values resulting from the DOE technical analysis could provide incentives to generate new waste, this concern is ameliorated to a degree by the requirement in these final regulations to assess each hydrogen production process by grouping major inputs with similar attributes, rather than allowing blends of feedstocks with different attributes to be evaluated as a single production process. The Treasury Department and the IRS will continue to study this issue to determine whether adjustments are needed in the future.

vi. Alternative Fate Considerations for Fugitive Methane From Fossil Fuel Activities Other Than Coal Mining

The proposed regulations did not recognize a pathway within 45VH2–GREET for determining lifecycle GHG emissions rates for the production of hydrogen using fugitive methane, but the preamble to the proposed regulations invited comment on the treatment of various sources of fugitive methane. In consultation with the DOE and the EPA and considering that fossil fuel activities other than coal mining are overwhelmingly comprised of oil and gas operations, these final regulations use productive use as the applicable

[55] U.S. Department of Energy, *A Generic Counterfactual Greenhouse Gas Emissions Factor for Life-Cycle Assessment of Manure-Derived Biogas and Renewable Natural Gas,* Washington, DC (2025), available at *https://www.energy.gov/45vresources.*

alternative fate for fugitive methane from these activities.

While some comments viewed the alternative fate of fugitive emissions to be venting, others noted the extensive existing regulatory requirements and additional incentives for avoiding fugitive emissions from oil and gas operations and argued that productive use is the appropriate alternative fate for this source of methane. The Treasury Department and the IRS note that the EPA's regulations under section 111 of the Clean Air Act seek to limit volatile organic compounds and methane emissions from oil and gas operations through a variety of requirements including performance standards as well as operational practices and leak detection and repair programs. *See* 40 CFR part 60 (Subparts OOOO, OOOOa, OOOOb, and OOOOc). For example, the EPA's latest rules for new sources require use of zero emitting process controllers in most scenarios. The EPA's previous rules allowed low bleed and intermittent bleed controllers, which emit pollutants to the atmosphere by discharging natural gas. The EPA's new rules keep that gas in the system instead of allowing it to be released. The EPA's new rules also phase out routine flaring of associated gas from most new oil wells, establish strong performance standards for emissions from storage tanks, include requirements for the efficiency of flares, and strengthen requirements for regular leak monitoring and deadline for repairs at well sites. The EPA's leak detection and repair program at well sites requires frequent monitoring of oil and gas equipment with approved technology and methods to look for leaks. If a leak is found, then it must be repaired quickly so that the equipment stops leaking fugitive emissions to the atmosphere. This program will reduce the amount of emissions coming from leaking components. The EPA's rules also require owners and operators of new wells to use best management practices to minimize or eliminate venting of emissions from gas well liquids unloading.

As discussed in part III.E.1, while some of the compliance deadlines under each of the updated regulations under section 111 of the Clean Air Act and updated reporting requirements in 40 CFR part 98 Subpart W have not yet passed, operators must plan for timely compliance with those requirements and must already comply with other requirements such as the new source requirements under section 111. Thus, operators have significant incentives to make certain compliance investments now and are required to do so well within the period of the section 45V credit. In addition, the Bureau of Land Management and most oil and gas producing States also regulate the waste of gas through venting and flaring, and some, such as New Mexico and Colorado, have regulations equally or more stringent than EPA requirements in many respects.[56] As a consequence, the majority of the actions that an oil or gas operator could take to avoid fugitive emissions are already, or during the life of the section 45V credit will be, required by law.

Given the extensive regulatory environment already in place requiring oil and gas operators to minimize GHG emissions from oil and gas operations, and the strong incentive and existing infrastructure to sell gas that is not lost through venting or flaring, the generally applicable alternative fate for fugitive emissions from fossil fuel activities other than coal mining is productive use. Accordingly, the final regulations provide that for purposes of determining the lifecycle GHG emissions rate of a process that uses fugitive methane other than coal mine methane, such as fugitive methane from oil and gas operations, productive use of such gas must be used as the alternative fate, which would result in emissions equivalent to the carbon intensity of using fossil natural gas. For example, the production of methane from virgin coal seams, which is commonly referred to as ''coalbed methane,'' (CBM) may be for the purpose of natural gas production or may result from pre-mining activities. Since it is typically of a comparable methane content as other natural gas sources, it is commonly sold for use. Nationwide, emissions that result from CBM extraction are currently reported to EPA's Greenhouse Gas Reporting Program under Subpart W, which informs background estimates of upstream methane emissions for the natural gas supply chain in 45VH2–GREET. Accordingly, lifecycle GHG emissions analyses conducted for purposes of section 45V would represent CBM with a carbon intensity that is equivalent to that of other sources of fossil natural gas.

d. Book and Claim

The Explanation of Provisions to the proposed regulations noted that hydrogen producers using natural gas alternatives would be required to acquire and retire corresponding attribute certificates through a book-and-claim system that can verify in an electronic tracking system that all applicable requirements are met. Hydrogen producers would also be required to have a pipeline interconnection and measurement using a revenue grade meter. These rules would apply to the use of certificates with both direct and indirect claims of use of natural gas alternatives. Direct use would involve the production of hydrogen with a direct exclusive pipeline connection to a facility that generates RNG or from which fugitive methane is being sourced, while non-direct use would involve producing hydrogen using RNG or fugitive methane sourced from a commercial or common-carrier natural gas pipeline. In all cases, attribute certificates would need to document the RNG or fugitive methane procurement for qualified clean hydrogen production claims and ensure that the environmental attributes of the RNG or fugitive methane being used are not sold to other parties or used for compliance with other policies or programs.

The Explanation of Provisions to the proposed regulations stated that before final regulations addressing the section 45V credit are issued, taxpayers will use 45VH2–GREET or the PER process to determine a lifecycle GHG emissions rate for hydrogen production facilities that rely on direct use of landfill gas or any fugitive methane feedstock, provided they meet the requirement that the gas being used results from the first productive use of methane from the landfill source or fugitive methane source. The term ''direct use'' means that there is a direct, exclusive pipeline connection between the hydrogen production facility and the source of the gas that is procured (for example, the upgrading or processing facility that produces RNG from landfill gas). Relative to a book-and-claim system, the direct connection between a gas supplier and a hydrogen production facility can reduce the uncertainty of pipeline leakage, tracking, and verification.

The Explanation of Provisions to the proposed regulations explained that the Treasury Department and the IRS are considering providing a rule that taxpayers would need to provide and maintain documentation to substantiate that (i) the gas being used results from the first productive use of the methane at the landfill source and is not displacing a previous productive use; and (ii) the environmental attributes of the gas being used, including those of the underlying biogas, are not sold to other parties or used for compliance with other policies or programs. When additional conditions addressing

[56] *See, for example,* Waste Prevention, Production Subject to Royalties, and Resource Conservation, 89 FR 25378 (Apr. 10, 2024).

hydrogen production pathways that use natural gas alternatives for purposes of the section 45V credit are determined, taxpayers would also be required to maintain documentation that the natural gas alternative being used meets those requirements and to acquire and retire any certificates that are established. The proposed regulations further explained that the Treasury Department and IRS were also considering providing rules for using certificates and documentation required in the event additional conditions for use of natural gas sources are later imposed.

The Explanation of Provisions to the proposed regulations further noted that tracking and verification mechanisms for RNG or fugitive methane specific to the needs of the section 45V credit are not yet available, and existing systems have limited capabilities for tracking and verifying pathways for natural gas alternatives, especially in the part of the production process before the methane has been reformed to RNG. The Explanation of Provisions to the proposed regulations indicated that existing tracking and verification systems do not clearly distinguish between inputs, verify or require verification of underlying practices claimed by RNG production sources, require proof of generator interconnection or revenue-quality metering, provide validation of generation methodology, include exclusively United States based-generation, verify generator registration, and track the vintage of generator interconnection. In the proposed regulations, the Treasury Department and IRS indicated that they were considering providing rules to address whether or how book-and-claim systems with sufficient tracking and verification mechanisms may be used to attribute the environmental benefits of RNG or fugitive methane to hydrogen producers in the final regulations. Additional certainty was also needed to accurately account for emissions from pathways that do not yet exist in 45VH2–GREET and from gas from natural gas alternatives that is injected into a commercial or common-carrier pipeline.

A range of comments advocating in favor of or against allowing the use of book-and-claim systems for natural gas alternatives were received in response to the proposed regulations. Several comments discussed how book-and-claim systems were commonplace within the RNG industry. In addition, several comments expressed concern about the viability of the RNG industry if the use of book-and-claim were not permitted under section 45V. Several comments stated that, because sources of natural gas alternatives are unevenly distributed throughout the United States and may not be located near prospective hydrogen projects, book-and-claim allows entities that do not have access to regional RNG sources to participate in the clean hydrogen economy. Several comments suggested there was clear Congressional intent to allow book-and-claim. One comment suggested that a ''mass balance'' model or an ''identity preservation'' model could be adopted if a book-and-claim system were disallowed.

Some comments expressed concerns about allowing book-and-claim. One comment suggested that there would be a mismatch between the support offered by the section 45V credit and the clean hydrogen-specific investment required of producers using a book-and-claim system; allowing section 45V credits for new or recently constructed hydrogen production facilities claiming production of qualifying hydrogen solely on the basis of RNG certificates, despite no meaningful change in operations compared to current ''business as usual'' practice, would not contribute to the development of new clean hydrogen technology and would therefore be contrary to the intention of the IRA. Several comments noted that any tracking system would not ensure that biomethane is not produced for the purpose of meeting demand for the biomethane market.

In response to these comments, after consultation with the DOE and the EPA, the Treasury Department and the IRS agree that, subject to certain conditions, safeguards, and requirements described later, a book-and-claim system is an acceptable mechanism for establishing claims to certain attributes of RNG or coal mine methane that is used in a hydrogen production process. Similar systems have been used in other programs for similar purposes. Although certificates that are acquired and retired in a book-and-claim system may not necessarily reflect the feedstocks in fact used by a hydrogen production facility, such systems can serve as an effective proxy for the use of certain feedstocks if certain conditions are required, and the acquisition and retirement of certificates would contribute to the development of the hydrogen production market. Both EPA's RFS and the CA LCFS employ a form of book-and-claim (sometimes referred to as ''mass balance''), and the DOE has advised that both programs have driven methane capture and productive use. The DOE has also advised that EACs used for electricity have demonstrably supported new clean power plants. When such systems meet the conditions and requirements described later, book-and-claim systems can be appropriate tools for RNG and coal mine methane verification, supporting the establishment of lifecycle emissions as required under section 45V and these final regulations. The acquisition and retirement of certificates meeting certain requirements establishes claims to the attributes represented by such certificates that are considered part of the hydrogen production process and the lifecycle GHG emissions associated with the process.

Some comments highlighted design challenges that should be addressed if the use of a book-and-claim system is allowed for purposes of section 45V. Several comments recommended that if a book-and-claim system were allowed, then such system should take measures to avoid double-counting of the same environmental attributes. Other comments suggested that any tracking system should be able to allocate emissions based on different levels of gas blending from different feedstocks, enable the differentiation of carbon capture rates to those different feedstock production pathways, and determine credit values based on these evaluations.

The Treasury Department and the IRS agree with many of these comments and have taken them into account in establishing the requirements for a book-and-claim system that taxpayers may use for purposes of section 45V. Before a tracking system is suitable for use for purposes of section 45V, it must be capable of robustly tracking claims to the use of attributes and protecting against double counting. In consultation with the DOE and the EPA, the Treasury Department and the IRS agree that book-and-claim systems must enable users to distinguish between feedstocks as relevant to determining lifecycle GHG emissions rates for purposes of section 45V, but the Treasury Department and the IRS do not view it as appropriate to require tracking systems to allocate emissions or otherwise calculate emissions associated with the RNG or coal mine methane represented by a certificate. The carbon intensity associated with the RNG or coal mine methane used to produce hydrogen may be determined in 45VH2–GREET or a PER using the attributes represented by certificates for such feedstocks.

Following consultation with the DOE and the EPA, and in consideration of the comments received and the requirements specified in these regulations regarding RNG and coal mine methane, these final regulations define in § 1.45V–4(f)(2)(vi) a ''gas energy attribute certificate'' (gas EAC) to

mean a tradeable contractual instrument, issued through a qualified gas EAC registry or accounting system (as defined in in § 1.45V–4(f)(2)(viii)), that represents the attributes of a specific unit of RNG or coal mine methane. A gas EAC may be traded with or separately from the underlying gas it represents. A gas EAC can be retired by or on behalf of its owner, which is the party that has the right to claim the underlying attributes represented by a gas EAC. These final regulations in § 1.45V–4(f)(2)(vii) define the term ''eligible gas EAC'' to mean a gas EAC that represents the quantity of RNG or coal mine methane that is produced by a facility that is registered on only one qualified gas EAC registry or accounting system (as defined in § 1.45V–4(f)(2)(viii)) and that, with respect to the RNG or coal mine methane to which the gas EAC relates, provides, at a minimum, the information specified in § 1.45V–4(f)(2)(vii)(A) through (F). The information specified in § 1.45V–4(f)(2)(vii)(A) through (F) will enable the attributes of the RNG or coal mine methane represented by a gas EAC to be appropriately evaluated in determining a lifecycle GHG emissions rate for purposes of section 45V. For example, the requirement in § 1.45V–4(f)(2)(vii)(E) for gas EACs to reflect the source or sources of the gas that comprises the RNG or coal mine methane associated with each gas EAC and any attributes required by 45VH2–GREET, or in the determination of a PER, to accurately determine the emissions associated with such RNG or coal mine methane is intended to require gas EACs in a book-and-claim system to form the basis for any material distinctions that are relevant to the determination of a lifecycle GHG emissions rate as those distinctions are reflected in 45VH2–GREET and may evolve over time.

In consultation with the DOE and the EPA, and in consideration of the comments received and the requirements specified in these regulations regarding RNG and coal mine methane, these final regulations provide that a qualified gas EAC registry or accounting system for RNG or coal mine methane is an electronic tracking system that (A) assigns a unique identification number to each certificate associated with RNG and coal mine methane tracked by such system; (B) requires independent verification of the source or sources of the gas that comprises the RNG or coal mine methane and any other factual considerations relevant to the lifecycle GHG emissions assessment for purposes of section 45V for tracking and verification purposes (self-reported data without independent verification are not allowed); (C) requires use of a revenue grade meter, with production volumes reported to the registry via an application programming interface (API) or with independent reporting to ensure accurate accounting for production volumes (self-reported data are not allowed); (D) enables verification that only one certificate is associated with each unit of RNG or coal mine methane; (E) verifies that each certificate is claimed and retired only once; (F) identifies the owner of each certificate and provides for documentation of the chain-of-custody of any transfers of certificates; (G) requires an attestation that a producer has not registered the RNG or coal mine methane with other registries; (H) provides a publicly accessible view (for example, through an application programming interface) of all currently registered RNG or coal mine methane production facilities in the tracking system to prevent the duplicative registration of such production facilities; and (I) requires verification of pipeline interconnection, if applicable. Such a qualified book-and-claim system would need to be accompanied by a robust third-party verification system or systems of the related production processes.

e. Qualifying Gas EAC Requirements

The Explanation of Provisions to the proposed regulations indicated that the temporal matching and deliverability requirements as applied to RNG and coal mine methane would be logically consistent with but not identical to the temporal matching and deliverability requirements for electricity-derived EACs. The Explanation of Provisions to the proposed regulations further indicated that any such requirements would be designed to reflect the ways in which additional RNG or demand for fugitive methane can impact lifecycle GHG emissions and also to address the differences between electricity and methane, including but not limited to the different sources of emissions, markets, available tracking and verification methods, and potential for perverse incentives.

A wide range of comments were received on temporal matching and deliverability requirements for natural gas alternatives. As relates to temporal matching, comments expressed differing views on whether to include a temporal matching requirement and, if so, over what timeframe the matching should be required. One comment argued against requiring temporal matching because the natural gas pipeline system operates on a displacement basis, where all injections are balanced with consumption and storage. The comment noted that physical volumes do not necessarily move but rather balance. Several comments noted that, unlike electricity, RNG has more steady flow year-round and has substantial storage available that can be used to address seasonal differences in demand. One comment also noted that, unlike electricity, natural gas and RNG production does not instantaneously rise and fall with natural gas and RNG demand. Therefore, the comment asserted that increased demand for RNG does not necessarily yield an immediate, simultaneous increase in natural gas production and related emissions.

Many comments discussed the appropriate timeframe for matching if a temporal matching requirement is included in the final regulations. One comment argued that biogas, RNG, and fugitive methane production are not weather dependent on a minute, hourly, daily, weekly, monthly, or quarterly basis, and therefore should be matched on an annual basis. Others noted that hourly time matching would be unworkable because the industry typically balances supply and demand on at least a monthly basis, and hydrogen production is often tracked quarterly. One comment stated that due to the large storage capacity for gas in the United States, it would be appropriate to allow use of any RNG produced in the same year or one year prior to the year the clean hydrogen was produced. Another comment requested that if an hourly matching requirement was put in place to consider grandfathering in facilities that begin construction prior to December 31, 2029, allowing such facilities to use annual temporal matching. One comment noted that temporally matching RNG production and RNG use does little to improve the accuracy of carbon intensity scores, that time matching with a period shorter than monthly would create an arbitrary burden with little benefit, and that matching on a monthly basis would make sense after a transition period. Other comments also supported monthly matching.

With respect to deliverability, the comments included a range of opinions about the size of the geographic regions under a deliverability requirement. One comment noted that the United States' natural gas pipeline network is sufficiently interconnected and has the proper infrastructure to permit inter-regional trade of natural gas, thus justifying either not having a matching

requirement or having one equivalent to the size of the contiguous United States. Another comment noted that such a requirement would be appropriate so as not to disadvantage specific regions of the country. One comment noted that book-and-claim accounting combined with an attestation requirement obviates the need for strict geographic or deliverability requirements. One comment noted that the risk of undesirable indirect emissions effects from geographic or temporal mismatches between sources and uses is very low for RNG because the marginal source of gas on the natural gas grid is the same at all times of the day, in all seasons of the year and in all regions of North America.

Other comments disagreed with treating the entire United States as a single, interconnected system. Some comments noted that any RNG claimed by a hydrogen producer should be required to be delivered into the same natural gas transmission network as the hydrogen producer claiming the utilization of the RNG in alignment with the deliverability requirement for electricity. One comment noted that a national approach fails to reckon with real-world system constraints that result in differentiated pricing, uneven emissions rates, and pipeline capacity limits, all of which can shape investment decisions in the broader energy system. Another comment stated that any RNG fed into the gas grid to be utilized by hydrogen producers should be fed into the same local gas distribution system where the clean hydrogen facility operates to fulfill the deliverability requirement. The comment asserted that such a measure could help ensure that GHG emissions from transport of the RNG or fugitive methane feedstock to the hydrogen production facility can be accounted for with some degree of certainty. Another comment noted that any biomethane claimed for hydrogen production for purposes of section 45V compliance should be physically deliverable to the hydrogen production plant to ensure a robust book and claim system with climate integrity, and that while much of the North American gas system is considered connected, there are key considerations to consider when designing rules for qualifying gas pathways. Several other comments requested that book-and-claim accounting include deliverability constraints that are consistent with accounting for the direct and indirect emissions of producing hydrogen with methane feedstocks. Likewise, some comments noted that the Treasury Department should further research the need for geographic boundary requirements on RNG book-and-claim to confirm whether there would be different emissions impacts across geographies.

Section 45V requires a determination of lifecycle GHG emissions rates to address direct and significant indirect emissions, and this requirement applies to the use of RNG or coal mine methane in a hydrogen production process. Other requirements applied to RNG and coal mine methane included in these final regulations address some of these emissions. As relates to deliverability and temporal matching, many comments indicate that, unlike electricity EACs, temporal matching and deliverability requirements for RNG and coal mine methane have less direct salience because of their different nature and market characteristics. The DOE has advised, for example, that while electricity markets are highly regionalized with marginal emissions varying substantially over space and time, the same is not as true for the delivery infrastructure related to natural gas. Natural gas travels over regional and inter-regional pipelines and, while constraints exist on that network, as does methane leakage, there are fewer obvious regional boundaries to those pipelines as compared to the electricity grid. Additionally, the DOE has advised that the marginal emissions rate of using natural gas from the interstate pipeline network does not vary dramatically over time, and certainly not on an hourly basis. In part, this is because there is considerable storage in the natural gas delivery infrastructure, again unlike electricity networks.

In light of all these considerations, the final regulations provide in § 1.45V–4(f)(4)(iii)(B) that deliverability requires geographic matching within the pipeline network in a region. For this purpose, the pipeline network in the contiguous United States is treated as a single region. Hydrogen producers located in and connected to a natural gas pipeline in the contiguous United States must purchase an eligible gas EAC for RNG or coal mine methane that was injected into the pipeline network in the contiguous United States for such eligible gas EAC to be considered a qualifying gas EAC. Alaska, Hawaii, and each U.S. territory will be treated as separate regions for this purpose. A hydrogen producer located in and connected to a natural gas pipeline in any of these regions is required to purchase and retire gas EACs from RNG or coal mine methane producers whose pipeline injection is located in the same region to meet the requirement provided in § 1.45V–4(f)(4)(iii)(B). The DOE has advised that delivery can occur within the national natural gas pipeline network. These final regulations further confirm that the deliverability requirement is met if the RNG or coal mine methane represented by the eligible gas EAC was delivered to the hydrogen production facility from the RNG or coal mine methane producer through a direct pipeline connection or other physical method of exclusive delivery.

With respect to temporal matching, in consultation with the DOE, these final regulations in § 1.45V–4(f)(4)(iii)(A) require monthly matching. Eligible gas EACs used to document RNG or coal mine methane inputs by a qualified hydrogen producer need to be time-stamped such that the calendar month of the pipeline injection is the same calendar month in which the qualified hydrogen producer uses the underlying gas. As with electricity EACs, the third-party verifier is required to validate the matching requirement. A monthly matching requirement is appropriate for at least three reasons. First, the DOE has advised that pipeline flow and embedded storage in the natural gas delivery infrastructure means that the flow of gas from source to sink is variable but that one month is a reasonable approximation. A monthly matching requirement therefore ensures that temporal matching approximates the physics of actual delivery. Second, the DOE has advised that there would be little or no benefit in terms of mitigating the risk of significant indirect emissions if the temporal matching requirement were to be more granular, for example daily or hourly. Third, unlike renewable sources of electricity, the volume of RNG or coal mine methane produced by a specific source is unlikely to vary substantially over the course of a day but may vary seasonally over the course of a year. A monthly matching requirement will appropriately capture these potential seasonal differences in the quantity of RNG and coal mine methane production. These final regulations further confirm that the temporal matching requirement is met if the RNG or coal mine methane represented by the eligible gas EAC was delivered to the hydrogen production facility from the RNG or coal mine methane producer, through a direct pipeline connection or other physical method of exclusive delivery.

Section 1.45V–4(f)(4)(iii) requires both temporal and deliverability requirements to be met for an eligible gas EAC to be considered a qualifying gas EAC that establishes a claim to the

attributes of the eligible gas EAC for purposes of section 45V.

Several comments suggested that existing systems, such as M–RETS, the EPA's RFS program, or the CA LCFS program, might have sufficient capabilities to enable book and claim accounting for purposes of section 45V. The EPA has advised that the tracking system used for the RFS is purpose-built for that program and would not be appropriate for use in the implementation of section 45V. Further, the EPA's RFS tracking system is not designed to differentiate among types of RNG by carbon intensity score and would not be usable for such a purpose even if it were otherwise appropriate to do so. The CA LCFS program uses what some stakeholders call a ''mass balance'' approach to tracking RNG, which is focused on tracking chain of custody based on review of contracts and related attestations, not via an electronic registry. The Treasury Department and the IRS, in consultation with the DOE, are concerned that a mass balance approach similar to the one employed by the CA LCFS program would be difficult to administer and is therefore not well suited for administration of the section 45V credit. M–RETS were identified by a number of stakeholders as an electronic registry that tracks RNG and that has been approved by several States in the administration of their programs.

In consultation with the DOE and the EPA, the Treasury Department and the IRS confirm that, under these final regulations, hydrogen producers using RNG or coal mine methane will be allowed to acquire and retire corresponding attribute certificates through a book-and-claim system that can verify in an electronic tracking system that all applicable requirements are met. As discussed further below, such an electronic tracking system must be robust, establish unique claims to the attributes of RNG and coal mine methane, and utilize a qualified third-party registry that meets certain requirements after such registries become available.

These final regulations establish requirements for certificates associated with RNG and coal mine methane, as well as qualification criteria for electronic book-and-claim registries. These requirements will help ensure that registries understand and will be capable of meeting the specific needs of these final regulations in a comparable fashion as qualified EACs, ensuring credible claims and no double counting while enabling assessments of certain emissions associated with RNG and coal mine methane. The Treasury Department and the IRS recognize, however, that the final regulations establish and announce specific requirements for gas EACs for the first time, and it may take time for systems and practices to adjust to meet these requirements. The Treasury Department and the IRS further note that experience with electronic registries for natural gas alternatives is less extensive than with EACs for electricity. The Treasury Department and the IRS are particularly concerned with the ability of systems to develop sufficient capability to robustly verify the waste sources generating biogas from which RNG is derived because such sources must be separately evaluated within 45VH2–GREET or in the determination of a PER. For example, use of RNG derived from biogas generated by animal waste and wastewater would be treated as distinct processes under these final regulations. Thus, tracking systems must verify the distinct upstream sources of biogas for RNG in a manner that allows the attributes of each source to be assessed in separate processes.

Based on the comments received and in consultation with the DOE, the Treasury Department and the IRS understand that book-and-claim registries will, in the future, be able to meet the requirements provided in these final regulations. While the Treasury Department and the IRS cannot predict precisely when one or more electronic registries will be able to fully meet the requirements provided by these regulations, upon consultation with the DOE, the Treasury Department and the IRS expect that two years after the date the requirements for such systems have been announced will allow time for an entity or entities to modify existing systems, or design and build new systems, sufficient to meet the requirements specified in these final regulations. If and when systems that can meet the requirements of these final regulations become available, but no earlier than January 1, 2027, the Secretary will determine whether an existing system meets the requirements established in these final regulations, and that such system may then be used to acquire and retire qualifying gas EACs under these final regulations. The use of book-and-claim accounting for RNG and coal mine methane will not be permitted until the Secretary makes this determination.

Until the use of book-and-claim accounting for RNG and coal mine methane is permitted, taxpayers will be required to substantiate their use of RNG and coal mine methane in the production of hydrogen through a direct pipeline connection to a supplier of natural gas alternatives or documentation of other physical methods of exclusive delivery. In such cases of direct physical delivery, the attributes of the RNG and coal mine methane must be conveyed to the qualified hydrogen producer in a way that ensures no double counting of such attributes.

Once book-and-claim is allowed via qualified tracking registries, electronic certificates issued by such registries will be required for both direct and indirect claims of use of RNG and coal mine methane. Direct use involves the production of hydrogen with a direct exclusive pipeline connection to a facility that generates RNG or from which coal mine methane is being sourced (or other physical method of exclusive delivery), while non-direct use would involve producing hydrogen using RNG and coal mine methane sourced from a natural gas pipeline. In the latter case, hydrogen producers would be required to have a pipeline interconnection and would need to measure pipeline injections via a revenue grade meter. In all cases, qualifying gas EACs would need to be acquired and retired pursuant to these final regulations to document the RNG and coal mine methane procurement for qualified clean hydrogen production claims and that the attributes of the RNG and coal mine methane being used are not sold to other parties.

IV. Verification

Section 45V(c)(2)(B)(ii) provides that no hydrogen is qualified clean hydrogen unless its production and sale or use is verified by an unrelated party.

Proposed § 1.45V–5 would have provided the procedures necessary for section 45V credit claimants to fulfill the statutory verification requirement of section 45V(c)(2)(B)(ii). Comments addressed many aspects of these proposed rules, which are discussed in this part IV of the Summary of Comments and Explanation of Revisions. These final regulations adopt the rules as proposed, with the modifications described in this part IV.

A. In General

Proposed § 1.45V–5(a) would have provided that a verification report must be attached to a taxpayer's Form 7210 for each qualified clean hydrogen production facility and for each taxable year in which the taxpayer claims the section 45V credit.

One comment argued that qualified verifiers should be required to directly report their verification findings to the IRS, saying it is necessary for public

confidence in the administration of section 45V.

While drafting both the proposed regulations and these final regulations, the Treasury Department and the IRS, in consultation with the DOE and the EPA, considered adopting a verification regime that would require such direct reporting. The final regulations do not adopt this provision because direct reporting by verifiers to the IRS is not reasonably administrable.

Another comment requested the creation of a ''streamlined'' verification process that small businesses that engage in self-use of produced hydrogen could elect into. Section 45V does not make any distinction based on the size of the hydrogen producer, and the importance of verification is the same regardless of producer's size. Accordingly, no additional, ''streamlined'' verification process is needed or appropriate.

A few comments requested that the verification report requirement be suspended for the 2023 tax year. Because the verification requirement is statutory and begins in 2023, these final regulations do not adopt this comment.

Some comments recommended that taxpayers be permitted to obtain verification reports on a quarterly instead of annual basis. While unclear, these comments appear to be recommending that the section 45V credit be determined on a quarterly basis. The period of time for which the credit is determined and for which the taxpayer must obtain a verification report is established by statute. Section 45V(a) provides that the section 45V credit is determined for ''any taxable year,'' meaning that the credit is determined on an annual basis. Allowing taxpayers to determine the credit on a quarterly basis would contravene the statute, and therefore this recommendation is not adopted.

The final regulations amend § 1.45V–5(a), however, to clarify that the taxpayer's Form 7210, or any successor form(s), are filed with the taxpayer's Federal income tax return or information return, which is consistent with the instructions to that form, and also make clarifying edits to the text of the regulation to eliminate redundant text.

B. Requirements for Verification Reports

Proposed § 1.45V–5(b) would have provided the general rule that a verification report specified in paragraph (a) of the same section must be prepared by a qualified verifier under penalties of perjury and must contain a production attestation, a sale or use attestation, a conflict attestation, a qualified verifier statement, certain general information about the taxpayer's hydrogen production facility, and any documentation necessary to substantiate the verification process given the standards and best practices of the qualified verifier's accrediting body and the taxpayer's circumstances and its hydrogen production facility.

Comments addressed many aspects of the specific rules governing the contents of the verification report, and these are addressed in the succeeding paragraphs of this Summary of Comments and Explanation of Revisions. Comments did not address the general rule of proposed § 1.45V–5(b), but these final regulations include an additional requirement that a verification report must include any other information required by IRS forms or instructions. This additional requirement ensures that the IRS is able to effectively administer the section 45V credit and meet the statutory requirement of section 45V(c)(2)(B)(ii).

C. Requirements for the Production Attestation

Proposed § 1.45V–5(c) would have provided the rules dictating the content of the production attestation within a verification report. Proposed § 1.45V–5(c)(1) would have provided that the production attestation must be an attestation that the qualified verifier performed a verification sufficient to determine that the operation of the taxpayer's hydrogen production facility and any EACs applied pursuant to § 1.45V–4(d) are accurately reflected in the amount of qualified clean hydrogen claimed on the taxpayer's Form 7210 and either the data the taxpayer entered into the most recent GREET model to determine the emissions rate claimed on the taxpayer's Form 7210, or the data the taxpayer submitted in the PER petition relating to the taxpayer's hydrogen and which was provided to the DOE to obtain the emissions value provided in the PER petition.

Some comments requested that the final regulations provide specific rules for verification of facility-specific data, including in the PER process, to ensure that emissions data is independently collected using objective quantification methods and that the data trail is immutable, auditable, transparent, and accessible by third parties.

The Treasury Department and the IRS agree that clarification is needed regarding verification of data specific to the facility. Accordingly, § 1.45V–5(c)(1) is modified to reflect that a verification report must reflect ''reasonable assurance'' in the operation of the hydrogen production facility and any EACs applied. The ''reasonable assurance'' standard is defined within the ISO 14064–3, and is reflected in other greenhouse gas regulations, such as the CA LCFS. Additionally, as discussed in part IV.H of this Summary of Comments and Explanation of Revisions, § 1.45V–5(h) is modified to reflect that a qualified verifier accredited under the American National Standards Institute National Accreditation Board must be accredited to conduct validation and verification in accordance with the requirements of ISO 14065:2020 and ISO 14064–3:2019. This clarifies that the verification report must be performed in accordance with those standards, or similar standards in the case of a verifier accredited under the CA LCFS program.

In addition, the production attestation requirements are modified to include an additional requirement in the case of any EACs applied pursuant to § 1.45V–4(d). Under this modification, verifiers must confirm that the electricity generator or generators associated with such EACs are not registered on multiple qualifying EAC registries, or, in the event such generators are registered on multiple qualifying EAC registries, each EAC undergoing verification from each such generator registered on multiple qualifying EAC registries is being issued by only one qualifying EAC registry. *See* § 1.45V–5(c)(2). Because qualifying EAC registries must provide a publicly accessible view of all currently registered generators in the tracking system to prevent the duplicative registration of generators, this verification requirement provides further guardrails against the risk of double counting EACs. The final regulations also make corresponding modifications to § 1.45V–5(b)(1) and (c)(1) regarding the accuracy of the inputs used to determine the lifecycle GHG emissions rate of hydrogen production processes.

Proposed § 1.45V–5(c)(2) and (3) would have required production attestations to specify the emissions rate and amount of qualified clean hydrogen produced that are claimed on the taxpayer's Form 7210, as well as the emissions value received from the DOE during the EVRP, if applicable. No comments addressed these provisions, so these final regulations adopt them as proposed, with renumbering.

D. Requirements for the Sale or Use Attestation

Proposed § 1.45V–5(d) would have provided rules governing the content of the sale or use attestation within a verification report. Proposed § 1.45V–5(d)(1) would have provided that the

sale or use attestation must be an attestation that the qualified verifier performed a verification sufficient to determine that the amount of qualified clean hydrogen that is specified in the production attestation and that is claimed on the taxpayer's Form 7210 has been sold, or has been used by a person who makes a verifiable use of such hydrogen.

Proposed § 1.45V–5(d)(2) would have provided a definition of verifiable use indicating that a verifiable use can occur within or outside the U.S., can be made by the taxpayer or another person; includes tolling arrangements; and does not include the generation of electricity for subsequent rounds of hydrogen production, venting, or flaring.

The proposed regulations requested comments on whether the regulations could adopt additional safeguards to prevent the use of hydrogen to generate electricity that is then directly or indirectly used to produce more hydrogen, the venting or flaring of hydrogen, and similar types of abusive section 45V credit claims, including claims from circular arrangements coordinating among multiple parties.

Comments construable as responding to this request focused on the anti-abuse rule of proposed § 1.45V–2(b), so these comments are addressed in part II.B of this Summary of Comments and Explanation of Revisions.

One comment asked for the final regulations to include broadly applicable examples of verifiable use, such as usage that replaces natural gas in production facilities or other industrial uses, or to specify what constitutes a verifiable use. Another comment recommended that the verifiable use rule not address indirect use of electricity generated from produced hydrogen to produce further hydrogen, citing the recycling of waste heat as a benign example of such indirect use.

The Treasury Department and the IRS agree that the operation of the verifiable use rule should be clarified and should not apply to the use to which byproducts of hydrogen use are put. Accordingly, these final regulations provide a clarifying modification to the text of the verifiable use rule in § 1.45V–5(d)(2)(i) and an example in renumbered § 1.45V–5(d)(3), which illustrates the application of § 1.45V–5(d)(2).

One comment asked that binding written offtake agreements be construed as sales for purposes of the sale or use attestation. However, in the absence of a regulatory definition of sale for section 45V purposes alone, whether a particular agreement constitutes a sale would be determined under general tax principles. There is insufficient justification for an exception to this result and thus these final regulations do not adopt the proposal. To the extent such an agreement is a sale for Federal income tax purposes, the taxpayer would not be eligible to claim the section 45V credit with respect to the hydrogen it sold until all relevant requirements, including the verification requirement, have been satisfied.

With respect to the comment's request for examples, or a specific definition of, verifiable use, these final regulations do not provide specific examples or specify a definition of verifiable use. The verifiable use rule is intended to prohibit abusive or wasteful uses of hydrogen that do not further the purpose of section 45V while providing flexibility in what constitutes a verifiable use. It is not meant to limit the universe of creditable uses of qualified clean hydrogen, and defining verifiable use could lead to that unintended result. However, to clarify some verifiable uses of qualified clean hydrogen, examples could include using qualified clean hydrogen in a fuel cell to produce electricity, or using qualified clean hydrogen to manufacture steel, among many other uses.

E. Requirements for the Conflict Attestation

Proposed § 1.45V–5(e) would have provided rules governing the content of the conflict attestation within a verification report. Proposed § 1.45V–5(e)(1) would have provided five representations the verifier must make in the conflict attestation, while proposed § 1.45V–5(e)(2) would have provided a special rule in the elections made under section 6418(a) with respect to the section 45V credit.

One comment expressed concern that the verifier conflict attestation, specifically the language at proposed § 1.45V–5(e)(1)(iii) reading, ''[t]he qualified verifier is not related, within the meaning of section 267(b) or 707(b)(1) of the Code, to, or an employee of, the taxpayer[,]'' appears to require hydrogen producers to test for conflict attribution with every employee of the qualified verifier, given the definition of ''related'' in sections 267(b) and 707(b)(1).

These final regulations do not adopt this comment. The language of proposed § 1.45V–5(e)(1)(iii) only requires testing whether the qualified verifier is related, within the meaning of section 267(b) or 707(b)(1), to the taxpayer, and whether the qualified verifier is an employee of the taxpayer. Proposed § 1.45V–5(e)(1)(iii) does not require application of any attribution or constructive ownership rules.

Proposed § 1.45V–5(e)(2) would have provided a special rule in the case of taxpayers making an election to transfer the credit under section 6418 to require the conflict attestation to attest that the verifier is independent of both the eligible taxpayer and the transferee. Because the identity of the transferee might not be known in time for the verifier to complete the conflict attestation, this special rule could create issues with timely preparing the conflict attestation. Proposed § 1.45V–5(e)(2) is therefore removed from these final regulations, and accordingly, §§ 1.45V–5(e)(1)(i) through (v) are renumbered as § 1.45V–5(e)(1) through (5). Correlative edits have also been made to proposed § 1.48–15(e)(2).

F. Requirements for the Qualified Verifier Statement

Proposed § 1.45V–5(f) would have provided rules governing the content of the qualified verifier statement within a verification report. No comments addressed this provision, so these final regulations adopt it as proposed.

G. General Information on the Taxpayer's Hydrogen Production Facility

Proposed § 1.45V–5(g) would have required certain information regarding the hydrogen production facility undergoing verification to be included in the verification report. No comments addressed this provision, so these final regulations adopt it as proposed.

H. Qualified Verifier

Proposed § 1.45V–5(h) would have defined a qualified verifier as any individual or organization with active accreditation as a validation and verification body from the American National Standards Institute National Accreditation Board (ANAB), or as a verifier, lead verifier, or verification body under the CA LCFS.

Some comments, including one from one of the accreditation bodies named in the proposed regulations, suggested that the final regulations specify the type of accreditation needed from the two named accreditation bodies to include International Organization for Standardization (ISO) standard 14065 and 14064–3. One of these comments noted that the CA LCFS program, one of the two named accreditation bodies, draws from ISO 14065 and 14064–3.

The Treasury Department and the IRS agree that, in the case of ANAB-accredited validation and verification bodies, the proposed regulations lack needed specificity. Accordingly, these

final regulations adopt the proposed regulations with a modification to limit the pool of ANAB-accredited qualified verifiers to those accredited under the ANAB Accreditation Program for Greenhouse Gas Validation and Verification Bodies.

I. Unrelated Party

Proposed § 1.45V–5(i) would have defined, for purposes of section 45V(c)(2)(B)(ii), the term ''unrelated party'' to mean a qualified verifier who meets the requirements of proposed § 1.45V–5(e). No comments addressed this provision, so these final regulations adopt it as proposed.

J. Requirements for Taxpayers Claiming Both the Section 45V Credit and the Section 45 Credit or the Section 45U Credit

Section 45(e)(13) provides that electricity produced by the taxpayer shall be treated as sold by such taxpayer to an unrelated person during the taxable year if such electricity is used during such taxable year by the taxpayer or a person related to the taxpayer at a qualified clean hydrogen production facility to produce qualified clean hydrogen, and such use and production is verified (in such form or manner as the Secretary may prescribe) by an unrelated third party.

Section 45U(c)(2) provides, among other things, that rules similar to the rules of section 45(e)(13) shall apply for purposes of section 45U.

Proposed § 1.45V–5(j) would have provided requirements for taxpayers claiming the section 45V credit concurrently with either the section 45 credit or the section 45U credit. No comments addressed this provision, so these final regulations adopt it as proposed with a minor clarification to § 1.45V–5(j)(3) that electricity represented by an EAC must be both *acquired* and retired.

K. Timely Verification Report

Proposed § 1.45V–5(k) would have provided that a verification report must be signed and dated by the qualified verifier no later than (i) the due date, including extensions, of the Federal income tax return or information return for the taxable year during which the hydrogen undergoing verification is produced; or (ii) in the case of a section 45V credit first claimed on an amended return or AAR, the date on which the amended return or AAR is filed.

Some comments expressed concern that a late verification report, filed with a taxpayer's return after the extended return filing due date for the taxable year of hydrogen production, would preclude taxpayers from making an elective payment election under section 6417 or a transferability election under section 6418. These comments were addressed in part I.C of this Summary of Comments and Explanation of Revisions.

One comment said the final regulations should allow for a late verification report to be filed with an amended return, reading the proposed regulations as allowing this in the first year only. While not entirely clear, the comment appeared to be requesting clarification that, for purposes of section 45V, a taxpayer may submit a late verification report with an amended return or AAR for any taxable year during the 10-year credit period, and not just the first year.

The Treasury Department and the IRS agree that further clarification is needed. As written, the proposed regulations could be read to suggest that a taxpayer may only file a late verification report on an amended return in the first taxable year of production. That result was not intended. Accordingly, § 1.45V–5(k)(2) is modified to provide that, in the case of a credit first claimed for the taxable year on an amended return or AAR, the verification report must be filed by the date on which the amended return or AAR is filed. This modification is intended to clarify that a late-filed verification report may be filed on an amended return for any taxable year during the 10-year credit period and not just the first taxable year of production.

V. Rules for Determining the Placed in Service Date for an Existing Facility That is Modified To Produce Qualified Clean Hydrogen

A. Modification of an Existing Facility

Under section 45V(d)(4), in the case of any facility that was originally placed in service before January 1, 2023, and, prior to the modification (described in section 45V(d)(4)(B)), did not produce qualified clean hydrogen, and after the date the facility was originally placed in service (i) is modified to produce qualified clean hydrogen, and (ii) amounts paid or incurred with respect to the modification are properly chargeable to the taxpayer's capital account, the facility will be deemed to have been originally placed in service as of the date the property required to complete the modification is placed in service. The rule in section 45V(d)(4) for modification of existing facilities applies to modifications made after December 31, 2022. *See* § 13204(a)(5)(C) of the IRA.

Proposed § 1.45V–6(a)(1) would have incorporated the statutory provisions of section 45V(d)(4). Proposed § 1.45V–6(a)(2) would have provided that an existing facility will not be deemed to have been originally placed in service as of the date the property required to complete the modification is placed in service unless the modification is made for the purpose of enabling the facility to produce qualified clean hydrogen and the taxpayer pays or incurs an amount with respect to such modification that is properly chargeable to the taxpayer's capital account for the facility. Proposed § 1.45V–6(a)(2) would also have provided that a modification is made for the purpose of enabling the facility to produce qualified clean hydrogen if the facility could not produce hydrogen with a lifecycle GHG emissions rate that is less than or equal to 4 kilograms of CO2e per kilogram hydrogen but for the modification. Changing inputs to the hydrogen production facility, such as switching from conventional natural gas to renewable natural gas, would not qualify as a facility modification for purposes of proposed § 1.45V–6(a)(2). Proposed § 1.45V–6(c) would have provided three examples illustrating the application of the rules provided by section 45V(d)(4) and § 1.45V–6(a).

Several comments were received on proposed § 1.45V–6(a)(1) and (2). Some comments requested that the final regulations provide that changing the fuel input in the hydrogen production process, such as changing from natural gas to renewable natural gas, qualifies as a facility modification for purposes of section 45V(d)(4). These comments further suggested that acquiring new feedstocks for the purpose of enabling the hydrogen production facility to produce qualified clean hydrogen should constitute a facility modification. Several other comments suggested that the final regulations should clarify that acquiring new feedstocks and the associated components needed to process such feedstocks, or constructing a new facility to produce such feedstocks, for the purpose of enabling the facility to produce qualified clean hydrogen, constitutes a facility modification, provided the amounts paid or incurred with respect to such modification are properly chargeable to the capital account of the taxpayer.

It is not appropriate to provide a special rule that changing fuel inputs or investing in new feedstock production technology is a modification under section 45V(d)(4). Section 45V(d)(4)(B)(ii) specifically requires that expenditures made with respect to a modification must be properly

chargeable to the taxpayer's capital account. Changing fuel inputs, without more, would not satisfy this statutory requirement. However, to the extent new components are installed in the hydrogen production facility in order to enable the facility to consume a different type of fuel that would enable the facility to produce qualified clean hydrogen, and to the extent such components are chargeable to the capital account of the taxpayer, then the installation of such new components would qualify as a modification under section 45V(d)(4), assuming all other requirements of § 1.45V–6(a)(2) are met. Regarding investing in new feedstock production technology, such investment would not constitute a modification under section 45V(d)(4) because it is not a modification to the hydrogen production facility, but instead a modification to the feedstock production facility.

Accordingly, these regulations retain the proposed approach and have clarified in § 1.45V–6(a)(2) that merely changing fuel inputs does not constitute a modification under section 45V(d)(4). Additionally, § 1.45V–1(a)(7)(ii)(B) is modified to clarify that feedstock production equipment is not part of the facility for purposes of section 45V(c)(3).

Several other comments requested that the final regulations clarify that there is no monetary threshold required for any capital expenditure paid or incurred with respect to modifications made to an existing facility originally placed in service before January 1, 2023, in order to enable the facility to produce qualified clean hydrogen, assuming all other requirements are met, for such facility to qualify under section 45V(d)(4) for a new deemed originally placed in service date.

These final regulations do not provide a rule specifying a monetary threshold. The relevant inquiry under section 45V(d)(4) and §§ 1.45V–6(a)(1) and (2) is whether the modification is made for the purpose of enabling the facility to produce qualified clean hydrogen and whether the taxpayer pays or incurs an amount with respect to such modification that is properly chargeable to the taxpayer's capital account. As set forth in § 1.45V–6(a)(2), the taxpayer must make a capital expenditure with respect to the modification, but there is no requirement that such expenditure satisfies a certain monetary threshold. To the extent the capital expenditure is for a modification that enables the facility to produce qualified clean hydrogen and the facility would not otherwise be able to produce qualified clean hydrogen but for the modification, such expenditure would satisfy the requirements of § 1.45V–6(a)(2), regardless of amount. Because section 45V(d)(4) and § 1.45V–6(a)(2) are sufficiently clear to enable taxpayers to determine whether their expenditure satisfies the requirements for the facility to receive a new deemed originally placed in service date, any further rules regarding a monetary threshold beyond the statutory text are unnecessary.

Finally, one comment requested that the final regulations provide that an existing facility that is modified to capture hydrogen that would have been flared or released but that is instead put to productive use is deemed to have been originally placed in service as of the date the modifications were placed in service. Although unclear, this comment appears to be requesting that an existing facility that previously produced qualified clean hydrogen before it was modified to capture such hydrogen be entitled to a new originally placed in service date under section 45V(d)(4). It would be inappropriate to provide such a rule. To the extent a facility produced qualified clean hydrogen before it was modified to capture such hydrogen, such modification would not meet the requirements of § 1.45V–6(a)(2) because the modification was not for the purpose of enabling the facility to produce qualified clean hydrogen. If, on the other hand, the facility did not produce qualified clean hydrogen before it was modified to capture hydrogen, then such modification could meet the requirements of § 1.45V–6(a)(2), provided that the modification enables the facility to produce qualified clean hydrogen. Whether the facility produces qualified clean hydrogen would depend on the lifecycle GHG emissions rate of the hydrogen production process. Because such inquiry would depend on the lifecycle GHG emissions rate of the hydrogen production process and is fact specific, these final regulations do not include a special rule for this scenario in the regulatory text.

B. Retrofit of an Existing Facility

Proposed § 1.45V–6(b) would have provided that an existing facility may establish a new date on which it is considered originally placed in service for purposes of section 45V, even though the facility contains some used property, provided the fair market value of the used property is not more than 20 percent of the facility's total value (the cost of the new property plus the value of the used property) (80/20 Rule). Proposed § 1.45V–6(b) would have further provided that for purposes of the 80/20 Rule, the cost of new property includes all properly capitalized costs of the new property included within the facility. Proposed § 1.45V–6(b) would have provided that, if a facility satisfies the requirements of the 80/20 Rule, then the date on which such facility is considered originally placed in service for purposes of section 45V(a)(1) is the date on which the new property added to the facility is placed in service. Proposed § 1.45V–6(b) would also have provided that the 80/20 Rule applies to any existing facility, regardless of whether the facility previously produced qualified clean hydrogen and regardless of when the facility was originally placed in service (before application of proposed § 1.45V–6(b)). Examples 4 and 5 of proposed § 1.45V–6(c) would have provided examples illustrating the application of the 80/20 Rule.

Several comments were received on the 80/20 Rule and proposed § 1.45V–6(b). Some comments requested clarification on what is included in the definition of an ''existing facility'' for purposes of the 80/20 Rule and whether the 80/20 Rule applies only to existing hydrogen production facilities, or whether it applies to all existing facilities regardless of whether they previously produced hydrogen. Similarly, one comment suggested that the term ''existing facility'' could mean a purchased facility or an already existing facility owned by the taxpayer. Other comments requested clarification as to whether a facility that otherwise meets the modification rule of section 45V(d)(4) would also be required to meet the 80/20 Rule in order to receive a new originally placed in service date. One comment requested that the 80/20 Rule only be applied to existing hydrogen production facilities. This comment further suggested that the final regulations should clarify that, for purposes of the 80/20 Rule, the unit of property to which the 80/20 Rule applies is a single production line as defined in proposed § 1.45V–1(a)(7)(i). For example, with respect to a project with multiple production lines that are capable of independently producing qualified clean hydrogen, this comment requested that the final regulations clarify that the 80/20 Rule would apply separately to each such production line.

One comment requested clarification on the extent to which used components of property owned by another person that function interdependently with components of property owned by the taxpayer to produce qualified clean hydrogen must be taken into consideration for purposes of the 80/20 Rule. This comment provided the example of transmission pipelines not

owned by the taxpayer but that are used to import methane to the hydrogen production facility, and asked whether such components would need to be taken into consideration for purposes of the 80/20 Rule.

One comment requested clarification on the extent to which roads, fences, buildings, land, and other ancillary property may be considered part of a qualified clean hydrogen production facility that must be taken into account for purposes of the 80/20 Rule.

Finally, one comment requested that proposed § 1.45V–6(b) be modified to allow taxpayers to exclude the cost of any maintenance, repairs, or upgrades when determining the value of used property for purposes of the 80/20 Rule.

The Treasury Department and the IRS agree that further clarification of the 80/20 Rule is appropriate. The proposed 80/20 Rule could have been interpreted to apply to all existing facilities, including those that satisfy the modification requirements of section 45V(d)(4) to receive a new deemed originally placed in service date. This was not the intent of proposed § 1.45V–6(b). Accordingly, the final regulations clarify in § 1.45V–6(a)(3) that a facility that satisfies the requirements of section 45V(d)(4) does not also need to meet the 80/20 Rule in order to be deemed to be originally placed in service as of the date that the property required for the modification is placed in service. Proposed § 1.45V–6(b) is also modified to clarify the scope of the 80/20 Rule. The final regulations under § 1.45V–6(b) now provide that the 80/20 Rule applies to retrofitted hydrogen production facilities and that the 80/20 Rule applies separately to each single production line containing used property.

These final regulations do not provide further rules addressing the extent to which used property owned by another person must be taken into consideration for purposes of the 80/20 Rule because existing Federal income tax concepts are sufficient to address the question posed in the comment. Likewise, these final regulations do not clarify whether roads, fences, buildings, land, or other ancillary property are part of the qualified clean hydrogen production facility for purposes of the 80/20 Rule. Existing Federal income tax concepts are sufficient to address this question. In determining the value of old or existing equipment as compared to new equipment, the general principles of Revenue Ruling 94–31 apply. Revenue Ruling 94–31 provides that a facility would qualify as originally placed in service even though it contains some used property, provided the fair market value of the used property is not more than 20 percent of the facility's total value (the cost of the new property plus the value of the used property). Some changes to the definition of ''facility'' are needed to clarify that feedstock transportation or feedstock transmission equipment, such as electricity transmission equipment, is not part of the qualified clean hydrogen production facility. Accordingly, proposed § 1.45V–1(a)(7)(ii)(B) is revised to exclude feedstock transmission equipment from the definition of ''facility.''

Finally, regarding whether proposed § 1.45V–6(b) should be modified to allow taxpayers to exclude the cost of maintenance, repairs, or upgrades from the value of used equipment for purposes of the 80/20 Rule, the final regulations do not adopt these suggestions because they are inconsistent with Federal income tax principles underlying the 80/20 Rule.

VI. Election To Treat Clean Hydrogen Production Facility as Energy Property

A. Overview

Section 48(a)(15) allows a taxpayer that owns and places in service a specified clean hydrogen production facility (as defined in section 48(a)(15)(C)) to make an irrevocable election to claim the section 48 credit in lieu of the section 45V credit for any qualified property (as defined in section 48(a)(5)(D)) that is part of the facility. Section 13204(c)(3) of the IRA provides that this provision is effective for property placed in service after December 31, 2022. For any property that is placed in service after December 31, 2022, and the construction of which begins before January 1, 2023, § 13204(c)(3) of the IRA provides that section 48(a)(15) applies only to the extent of the basis of such property that is attributable to construction, reconstruction, or erection occurring after December 31, 2022.

Proposed § 1.48–15(a) would have provided that a taxpayer that owns and places in service a specified clean hydrogen production facility (as defined in section 48(a)(15)(C) and proposed § 1.48–15(b)) can make an irrevocable election under section 48(a)(15)(C)(ii)(II) to treat any qualified property (as defined in section 48(a)(5)(D)) that is part of the facility as energy property for purposes of section 48.

Proposed § 1.48–15(b) would have defined the term ''specified clean hydrogen production facility'' to mean any qualified clean hydrogen production facility (within the meaning of section 45V(c)(3) and proposed § 1.45V–1(a)(10)): (i) that is placed in service after December 31, 2022; (ii) with respect to which no section 45V credit or section 45Q credit has been allowed, and for which the taxpayer makes an irrevocable election to have section 48(a)(15) apply; and (iii) for which an unrelated party has verified in the manner specified in proposed § 1.48–15(e) that such facility produces hydrogen through a process that results in lifecycle GHG emissions that are consistent with the hydrogen that such facility was designed and expected to produce under section 48(a)(15)(A)(ii) and proposed § 1.48–15(c).

Proposed § 1.48–15(c)(1) would have provided the energy percentage (used by a taxpayer to calculate a section 48 credit) for a specified clean hydrogen production facility that is designed and reasonably expected to produce qualified clean hydrogen through a process that results in a lifecycle GHG emissions rate of not greater than 4 kilograms of CO2e per kilogram of hydrogen. Proposed § 1.48–15(c)(2) would have further provided that ''designed and reasonably expected to produce'' means hydrogen produced through a process that results in the lifecycle GHG emissions rate specified in the annual verification report for the taxable year in which the section 48(a)(15) election is made.

The Treasury Department and the IRS solicited feedback on the proposed definition of the term ''designed and reasonably expected to produce'' and whether there are any challenges to using the lifecycle GHG emissions rate achieved in the taxable year in which the section 48(a)(15) election is made to determine the facility's energy percentage for purposes of calculating the section 48 credit amount. No comment addressed the definition of the term ''designed and reasonably expected to produce'' or the challenges of using the lifecycle GHG emissions rate determined in the year the election takes place. However, one comment recommended that the final regulations allow for taxpayers that make the section 48(a)(15) election to determine their energy percentage by using a lifecycle GHG emissions rate achieved in a later taxable year. Section 48(a)(1) generally provides that the energy credit for any taxable year is the energy percentage of the basis of each energy property placed in service during such taxable year. This means that while a taxpayer is required to determine the lifecycle GHG emissions rate of the hydrogen undergoing verification each year of the recapture period specified in proposed § 1.48–15(f)(3), the credit amount may only be determined based on the lifecycle GHG emissions rate of the hydrogen produced in the year the

specified clean hydrogen production facility is placed in service. Allowing the use of a lifecycle GHG emissions rate achieved in a later taxable year is inconsistent with section 48(a)(1), since the section 48 credit is claimed only in the taxable year in which energy property is placed in service. Therefore, these final regulations adopt these proposed rules without change on these issues.

The proposed regulations would have required for each facility an annual assessment of the lifecycle GHG emissions rate for purposes of determining the rate at which a facility is designed and reasonably expected to produce qualified clean hydrogen, for verification purposes, and in determining whether a recapture event has occurred. In determining the amount of the section 45V credit and whether hydrogen is qualified clean hydrogen, the final regulations require a determination of lifecycle GHG emissions for each hydrogen production process conducted by a facility during a taxable year. However, applying a process-by-process-based approach to determining lifecycle GHG emissions rates for hydrogen production in the context of the section 48(a)(15) election could lead to a facility producing hydrogen in processes that result in multiple different emissions rates within a taxable year, which is inconsistent with the statutory scheme applicable to specified clean hydrogen production facilities and would be difficult to administer. Thus, the final regulations retain the single annual lifecycle GHG emissions rate assessment requirement for specified clean hydrogen production facilities for purposes of the section 48(a)(15) election by requiring, in the case of a facility that produces hydrogen through multiple processes, that the lifecycle GHG emissions rate be determined using the weighted average of the lifecycle GHG emissions rates of all hydrogen production processes. An annual assessment for each qualified clean hydrogen production facility best implements the statutory directive in section 48(a)(15)(A)(ii)(I) through (IV) and (C)(iii) to determine eligibility for and the amount of the section 48 credit based on the ''lifecycle greenhouse gas emissions which are consistent with the hydrogen that such facility was designed and expected to produce.''

B. Election Procedures

1. Time and Manner of Making Election

Proposed § 1.48–15(d)(1) would have provided rules for making an election under section 48(a)(15)(C)(ii)(II). To make such an election, a taxpayer must claim the section 48 credit with respect to a specified clean hydrogen production facility on a Form 3468, *Investment Credit,* or any successor form(s), and file the form with the taxpayer's Federal income tax return or information return for the taxable year in which the specified clean hydrogen production facility is placed in service. The taxpayer must also attach a statement to its Form 3468, or any successor form(s), filed with its Federal income tax return or information return that includes all the information required by the instructions to Form 3468, or any successor form(s), for each specified clean hydrogen production facility subject to an election. Proposed § 1.48–15(d)(1) would have provided that a separate election must be made for each specified clean hydrogen production facility that meets the requirements provided in section 48(a)(15) to treat the qualified property that is part of the facility as energy property.

Proposed § 1.48–15(d)(1) would have further provided that, if any taxpayer owning an interest in a specified clean hydrogen production facility makes an election with respect to the facility, then that election would be binding on all taxpayers that directly or indirectly own an interest in the facility. Thus, consistent with section 48(a)(15)(B), if a taxpayer owning an interest in a specified clean hydrogen production facility makes an election under section 48(a)(15)(C)(ii)(II), then no other taxpayer owning an interest in the same facility will be allowed a section 45V credit or section 45Q credit with respect to the facility or any carbon capture equipment included at such facility.

The Treasury Department and the IRS requested comments on whether, in the context of a specified clean hydrogen production facility that is directly owned through an arrangement properly treated as a tenancy-in-common for Federal income tax purposes or through an organization that has made a valid election under section 761(a) of the Code, each co-owner's or member's undivided ownership share of the qualified property comprised in the facility should be treated for purposes of section 48(a)(15)(C)(ii)(II) as a separate facility owned by such co-owner or member, with each such co-owner or member eligible to make a separate election under section 48(a)(15)(C)(ii)(II) to claim the section 48 credit in lieu of the section 45V credit with respect to its undivided ownership interest in the facility or share of the underlying qualified property. No comments were received in response to this request.

One comment requested that the Treasury Department and the IRS clarify how to allocate costs and benefits of a qualified clean hydrogen production facility for purposes of determining the section 45V and section 48 credit amounts. To the extent the comment sought clarification on how one taxpayer can claim both credits on the same facility, the election to claim the section 48 credit in lieu of the section 45V credit is made on the entire specified clean hydrogen production facility. If a taxpayer makes the election with respect to a specified clean hydrogen production facility, then no section 45V credit is allowed to the taxpayer with respect to such facility. Therefore, no allocation between the two credits for the same facility is allowed. Alternatively, to the extent the comment sought clarification on how to allocate the section 45V credit amount to co-owners of the same qualified clean hydrogen production facility, sections 45V(d)(1) and 45(e)(3) provide rules for how to allocate the section 45V credit amount to co-owners. As set forth in section 45(e)(3), in the case of a facility in which more than one person has an ownership interest, production from the facility is allocated among such persons in proportion to their ownership interests in the gross sales from such facility. No clarification is needed under proposed § 1.48–15(d)(1) and thus, these final regulations adopt this provision without change.

2. Special Rule for Partnerships and S Corporations

Proposed § 1.48–15(d)(2) would have provided that, in the case of a specified clean hydrogen production facility owned by a partnership or an S corporation, the election under section 48(a)(15)(C)(ii)(II) would be made by the partnership or S corporation and would be binding on all ultimate credit claimants (as defined in § 1.50–1(b)(3)(ii)). Proposed § 1.48–15(d)(2) further provided procedures for a partnership or S corporation to make an election with respect to a specified clean hydrogen production facility under section 48(a)(15)(C)(ii)(II). No comments were received on proposed § 1.48–15(d)(2), and the final regulations adopt this provision without substantive change.

3. Election Revocability

Proposed § 1.48–15(d)(3) would have provided that the election to treat any qualified property that is part of a specified clean hydrogen production facility as energy property would be irrevocable. No comments were received on proposed § 1.48–15(d)(3), and this

provision is adopted without change in these final regulations.

4. Election Availability Date

Proposed § 1.48–15(d)(4) would have provided that the election to treat any qualified property that is part of a specified clean hydrogen production facility as energy property would be available for property placed in service after December 31, 2022, and, for any property that began construction before January 1, 2023, only to the extent of the basis thereof attributable to the construction, reconstruction, or erection after December 31, 2022. No comments were received on proposed § 1.48–15(d)(4), and these final regulations adopt this provision without change.

5. Beginning of Construction Safe Harbor

These final regulations add § 1.48–15(d)(5), which provides that a taxpayer may, in its discretion, make an irrevocable election effective for the remaining taxable years within the period described in § 1.48–15(f)(3), to treat the latest version of 45VH2–GREET that was publicly available on the date when construction of the specified clean hydrogen production facility began as the 45VH2–GREET Model. In the case of a facility owned by the taxpayer that began construction prior to December 26, 2023, § 1.48–15(d)(5) provides that taxpayers may make an irrevocable election to treat the first publicly-available version of 45VH2–GREET (that is, the version of 45VH2–GREET released in December 2023) as the 45VH2–GREET Model for the remaining taxable years within the period described in § 1.48–15(f)(3). In the case of a facility that is modified to produce qualified clean hydrogen under section 45V(d)(4) or a facility that is retrofitted in a manner that entitles the facility to a new placed in service date under § 1.45V–6(b), the date when construction of the facility began is the date when construction of such modification or retrofit began. Under § 1.48–15(d)(5)(ii), a taxpayer makes this election by attaching a statement to the Form 3468 or any successor form(s). The taxpayer must make this election no later than the due date for filing its Federal income tax return or information return (including extensions) for the taxable period in which such facility is placed in service. A taxpayer who placed its facility in service before January 1, 2024, must make the election by no later than the close of the period of limitation on filing a claim for credit or refund under section 6511(a) for the taxable period in which such facility is placed in service.

6. Provisional Emissions Rate

Neither section 48 nor the proposed regulations contain a specific provision addressing a PER for energy credit purposes, leaving a procedural gap for obtaining a PER should a taxpayer that owns and places in service a specified clean hydrogen production facility (as defined in section 48(a)(15)(C) and § 1.48–15) make an irrevocable election under section 48(a)(15)(C)(ii)(II) to treat any qualified property (as defined in section 48(a)(5)(D)) that is part of the facility as energy property for purposes of section 48. To address this procedural gap, these final regulations add § 1.48–15(d)(6), which provides the procedures for obtaining a PER for such taxpayers. This provision largely tracks the PER rules of § 1.45V–4(c).

Section 1.48–15(d)(6)(i) provides that a taxpayer files a petition with the Secretary for a PER by following the procedures stated in § 1.45V–4(c)(3) through (5), except, in lieu of attaching the PER petition to the Form 7210 in the first taxable year of production as specified in § 1.45V–4(c)(3), the taxpayer must attach the PER petition to the Form 3468, *Investment Credit,* or a successor form, attached to the taxpayer's Federal income tax return for the taxable year in which the specified clean hydrogen production facility is placed in service. A taxpayer may use such PER to calculate the amount of the section 48 credit with respect to a specified clean hydrogen production facility, provided that (1) the lifecycle GHG emissions rate of the hydrogen produced at the specified clean hydrogen production facility has not been determined (for purposes of section 45V(c)(2)(C)) under the 45VH2–GREET Model, (2) there are no material changes to the information about the taxpayer's hydrogen production process from the information provided to the DOE to obtain an emissions value pursuant to § 1.45V–4(c)(2)(i), and (3) all other requirements of section 48(a)(15) are met. These final regulations further provide that a ''material change'' means any change that would cause a qualified verifier (as defined § 1.45V–5(h)) to be unable to complete a verification under § 1.48–15(e).

Further, § 1.48–15(d)(6)(iii) is added to provide that a taxpayer may, in its discretion, make an irrevocable election, effective for the remaining taxable years within the period described in § 1.48–15(f)(3), to treat the first version of 45VH2–GREET that includes the taxpayer's specified clean hydrogen production facility's hydrogen production pathway (as described in § 1.45V–4(c)(2)(i)) as the 45VH2–GREET Model. A taxpayer makes this election by attaching a statement to the Form 3468 or any successor form(s). The taxpayer must make this election by no later than the due date for filing its Federal income tax return or information return (including extensions) for the taxable period in which the taxpayer's facility is placed in service. A taxpayer who placed its specified clean hydrogen production facility in service before January 1, 2024, must make this election by no later than the close of the period of limitation for filing a claim for credit or refund under section 6511(a) for the taxable period in which such facility is placed in service.

Further, § 1.48–15(d)(6)(iv) is added to provide that, notwithstanding the requirement of § 1.48–15(d)(6)(i)(A), a taxpayer who received an emissions value from the DOE with respect to a specified clean hydrogen production facility (pursuant to § 1.45V–4(c)(2)(i)) before the date when construction of the facility began may, in its discretion, continue to use the PER determined by the Secretary and the associated emissions value to calculate the lifecycle GHG emissions rate of the hydrogen produced at the specified clean hydrogen production facility for the remainder of the period described in § 1.48–15(f)(3), provided that the taxpayer continues to satisfy the requirements of §§ 1.48–15(d)(6)(i)(B) and (C).

Finally, § 1.48–15(d)(6)(v) is added to provide that the Secretary's PER determination is not an examination or inspection of books of account for purposes of section 7605(b) of the Code and does not preclude or impede the IRS (under section 7605(b) or any administrative provisions adopted by the IRS) from later examining a return or inspecting books or records with respect to any taxable year for which the section 48 credit is claimed. For example, the annual verification report submitted under section 48(a)(15)(C)(iii) and § 1.48–15(e)(2) and any information, representations, or other data provided to the DOE in support of the request for an emissions value are still subject to examination. Further, a PER determination does not signify that the IRS has determined that the requirements of section 48, including the cross-references to section 45V, have been satisfied for any taxable year.

C. Third-Party Verification

Proposed § 1.48–15(e)(1) would have provided that, in the case of a taxpayer that makes an election under section 48(a)(15)(c)(ii)(II) to treat any qualified property that is part of a specified clean

hydrogen production facility as energy property for purposes of the section 48 credit, the taxpayer must obtain an annual verification report for the taxable year in which the election is made and for each taxable year thereafter of the recapture period specified in proposed § 1.48–15(f)(3). Proposed § 1.48–15(e)(1) would have further provided that the taxpayer must also submit the annual verification report as an attachment to the Form 3468, or any successor form(s), for the taxable year in which the election is made.

Proposed § 1.48–15(e)(2) would have provided procedures for the annual verification report, including where a transfer election has been made under section 6418(a) of the Code with respect to the section 48 credit for a specified clean hydrogen production facility.

No comments were received on proposed § 1.48–15(e). These final regulations adopt this provision without substantive change, other than conforming changes to modifications previously noted.

D. Credit Recapture

Section 48(a)(15)(E) directs the Secretary to issue such regulations or other guidance as determined necessary to carry out the purposes of section 48, including regulations or other guidance addressing recapture of so much of the credit allowed under section 48 as exceeds the amount of the credit that would have been allowed if the expected production were consistent with the actual verified production or all of the credit so allowed in the absence of such verification.

1. Emissions Tier Recapture Events Under Section 48(a)(15)(E)

Proposed § 1.48–15(f)(1) would have provided that, for purposes of section 48(a)(15)(E), in any taxable year of the recapture period specified in proposed § 1.48–15(f)(3) in which an emissions tier recapture event (as defined in proposed § 1.48–15(f)(2)) occurs, the tax imposed on the taxpayer under chapter 1 of the Code for the taxable year of the emissions tier recapture event is increased by the recapture amount specified in proposed § 1.48–15(f)(4).

Proposed § 1.48–15(f)(2) would have provided that an emissions tier recapture event under section 48(a)(15)(E) occurs during any taxable year of the recapture period specified in proposed § 1.48–15(f)(3) under the following circumstances: (i) the taxpayer fails to obtain an annual verification report by the deadline for filing its Federal income tax return or information return (including extensions) for any taxable year in which an annual verification report was required under proposed § 1.48–15(e)(1); (ii) the specified clean hydrogen production facility actually produced hydrogen through a process that results in a lifecycle GHG emissions rate that can only support a lower energy percentage than the energy percentage used to calculate the amount of the section 48 credit for such facility for the year in which the facility is placed in service; or (iii) the specified clean hydrogen production facility actually produced hydrogen through a process that results in a lifecycle GHG emissions rate of greater than 4 kilograms of CO_2e per kilogram of hydrogen.

No comments were received on proposed § 1.48–15(f)(1) and (2). These final regulations adopt these provisions without substantive change.

2. Recapture Period Under Section 48(a)(15)(E)

Proposed § 1.48–15(f)(3) would have provided that the recapture period begins on the first day of the first taxable year after the taxable year in which the facility was placed in service and ends on the last day of the fifth taxable year after the close of the taxable year in which the facility was placed in service. For example, if a calendar-year taxpayer places in service a specified clean hydrogen production facility on June 1, 2023, then the last day of the fifth taxable year following the close of the taxable year in which the facility was placed in service is December 31, 2028. Therefore, the recapture period is January 1, 2024, through December 31, 2028.

No comments were received on proposed § 1.48–15(f)(3). These final regulations adopt this provision without change.

3. Recapture Amount

Proposed § 1.48–15(f)(4) would have provided rules for computing the amount recaptured under section 48(a)(15)(E). Proposed § 1.48–15(f)(5) would have provided an example illustrating the application of proposed § 1.48–15(f)(1) through (4).

The preamble to the proposed regulations provided that, unless modified in future guidance, any reporting of emissions tier recapture under proposed § 1.48–15(f) is made on the taxpayer's annual tax return. The preamble further provided that, the Secretary may issue future guidance and/or prescribe tax forms and instructions to address the reporting of emissions tier recapture under proposed § 1.48–15(f) and any additional annual reporting obligations. The Treasury Department and the IRS solicited feedback on the reporting of recapture and any additional annual reporting obligations. No comments were received in response to this request, or on proposed § 1.48–15(f)(4) or (5) in general. These provisions are adopted as proposed with minor clarifications to the example in § 1.48–15(f)(5) to account for, among other things, the passage of time. However, as a clarification, the reporting of an emissions tier recapture event is reported using Form 4255, *Recapture of Investment Credit,* or any successor form(s), and the associated tax liability reported on the taxpayer's annual return.

4. Coordination With Recapture Rules Under Sections 50 and 48(a)(10)(C)

Proposed § 1.48–15(f)(6) would have provided that, during any taxable year of the recapture period for any credit allowed under section 48(a) with respect to qualified property that is part of a specified clean hydrogen production facility, the recapture rules would be applied, if applicable, in the following order: (i) section 50(a) (recapture in case of dispositions, etc.); (ii) section 48(a)(10)(C) (recapture relating to the prevailing wage requirements); and (iii) section 48(a)(15)(E) (emissions tier recapture).

There were no comments received on proposed § 1.48–15(f)(6). These final regulations adopt the provision without substantive change. The final regulations also add two examples to illustrate the application of § 1.48–15(f)(6).

E. Recordkeeping

Proposed § 1.48–15(g) would have provided that, consistent with section 6001 of the Code, a taxpayer making the election under section 48(a)(15)(C)(ii)(II) with respect to a specified clean hydrogen production facility must maintain and preserve records sufficient to establish the amount of the section 48 credit claimed by the taxpayer. Further, proposed § 1.48–15(g) would have provided that, at a minimum, those records include records to substantiate the information required to be included in the annual verification report under proposed § 1.48–15(e)(2), records establishing that the facility meets the definition of a specified clean hydrogen production facility under section 48(a)(15)(C) and proposed § 1.48–15(b), and records establishing the date the specified clean hydrogen production facility was placed in service. Finally, proposed § 1.48–15(g) would have provided that, if the increased section 48 credit amount was allowed under

section 48(a)(9), then the taxpayer must also maintain records in accordance with § 1.45–12.

No comments were received with respect to proposed § 1.48–15(g). However, the intent of proposed § 1.48–15(g) was to conform the recordkeeping requirements for making the election under section 48(a)(15) with the recordkeeping requirements for claiming the credit under section 45V. Some of the recordkeeping requirements provided in proposed § 1.45V–2(c) were not provided in proposed § 1.48–15(g). For example, records of past credit claims under section 45Q by any taxpayer with respect to carbon capture equipment included at the facility, and the requirement that taxpayers retain all raw data used for submission of a request for an emissions value to the DOE for at least six years after the due date (including extensions) for filing the Federal income tax return or information return to which the PER is ultimately attached, were unintentionally omitted from proposed § 1.48–15(g). Accordingly, conforming changes have been made to § 1.48–15(g) to include these items in the list of recordkeeping materials required to be maintained for taxpayers making the election under section 48(a)(15). Additionally, the final regulations add a requirement to retain the annual verification report required under § 1.48–15(e)(2).

VII. Additional Comments

A. Interaction With Other Tax Credits

Some comments requested clarification on the interaction of section 45V with other tax credits. One comment requested clarification that a renewable fuel facility that relies on a hydrogen production facility to produce renewable fuel is not part of the hydrogen production facility under proposed § 1.45V–1(a)(7).

These final regulations do not specify the interaction of section 45V with other tax credits except as it relates to section 45V(d)(2) and the prohibition on claiming the section 45Q credit. The Code sections themselves specify the interaction of section 45V with other tax credits. To the extent the statutes do not specify the interaction, imposing rules governing or restricting the section 45V credit on account of other tax credits whose statutes contain no such restriction would also not be applicable to this rulemaking.

Regarding the request for clarification on whether a renewable fuel facility that relies on a hydrogen production facility to produce renewable fuel is not part of the hydrogen production facility, this comment appears to be requesting clarification on the scope of the definition of facility under section 45Z. The definition of facility under section 45Z is beyond the scope of this rulemaking, and, therefore, is not addressed further herein.

B. Additional Reporting and Disclosure Requirements

Some comments requested that the final regulations impose additional reporting requirements on section 45V credit claimants, including to require claimants to publicize that they claimed the section 45V credit, the extent to which they engaged with the community, the amount of any emissions reductions associated with their section 45V credit claim, and various other hydrogen production activities such as water withdrawals, non-greenhouse gas air pollution, hydrogen leaks, and safety incidents. Similarly, some comments requested that the IRS disclose information about section 45V credit claims and the effect of section 45V credit claimants' hydrogen production activities.

Additional reporting and disclosure requirements are not incorporated into these final regulations. Section 45V does not impose any requirements on taxpayers to publicly disclose information about their section 45V credit claims or their hydrogen production activities. Further, section 6103 of the Code prohibits the IRS from disclosing information about section 45V credit claims, except as expressly authorized under another provision of the Code. Accordingly, imposing such additional reporting requirements, or disclosing information about section 45V credit claims, would contravene the Code and is not adopted in these final regulations.

Some comments requested that the Treasury Department and the IRS engage with environmental groups, industry participants, and the public in the implementation of the section 45V credit. Other comments requested that the Treasury Department and the IRS engage certain population groups, such as minorities, women, or veterans, to ensure meaningful participation by those groups. The Treasury Department and the IRS confirm that members of the public have been engaged on a broad basis through the notice and comment process and that public comments have been considered in issuing these final regulations.

C. Additional Procedural Requirements

One comment suggested that the Treasury Department and the IRS's identification of 45VH2–GREET as the most recent GREET model under section 45V(c)(1)(B) is an ''incorporation by reference'' and that, as such, modifications to 45VH2–GREET should be published in the **Federal Register** for notice and comment. This same comment noted that incorporation by reference generally refers to incorporating outside rules or sources into government regulations but posited that incorporation by reference can also apply to 45VH2–GREET. On this point, the comment did not request changes to the regulatory text. Furthermore, future events such as updates to 45VH2–GREET will not affect the text of these final regulations.

Regarding incorporation by reference, the Secretary's designation of 45VH2–GREET as a successor model under section 45V(c)(1)(B) is not an incorporation by reference. Incorporation by reference derives from 5 U.S.C. 552(a)(1), which requires regulatory rules to be published in the **Federal Register**. Incorporation by reference of matters published outside of the **Federal Register** provides an exception to this requirement by deeming those matters as published in the **Federal Register**. *See* 5 U.S.C. 551(a)(1).

In this case, 45VH2–GREET is not required to be published in the **Federal Register** because it is a statutory requirement. Section 45V(c)(1)(B) provides that lifecycle GHG emissions ''shall only include emissions through the point of production (well-to-gate), as determined under the most recent Greenhouse gases, Regulated Emissions, and Energy use in Transportation model (commonly referred to as the 'GREET model') developed by Argonne National Laboratory, or a successor model (as determined by the Secretary).'' As described in the Summary of Comments and Explanation of Revisions to these final regulations, the Secretary designated 45VH2–GREET as a successor model pursuant to that statutory directive, and 45VH2–GREET may also be appropriately considered the most recent GREET model. Because statutes may refer to matters that are not published in the **Federal Register**, the statutorily designated use of 45VH2–GREET as a successor model by the Secretary (or as the most recent GREET model) provides authorization, if not a direct mandate, to require the model's use and therefore eliminates the need for incorporating it by reference. *See United States* v. *Jackson,* No. 1:07–CR–108–ODE–GGB, 2007 WL 9735479, at *3 (N.D. Ga. Sept. 12, 2007), *report and recommendation adopted,* No. 1:07–CR–108–ODE, 2007 WL 9735481 (N.D. Ga. Oct. 23, 2007) (incorporation of

consumer price index as an inflation adjustor was not an APA violation); *Clarry* v. *United States,* 891 F. Supp. 105, *aff'd* 85 F.3d 1041 (2d Cir. 1995) (''[T]he APA's notice requirements apply to rules formulated and adopted by an agency, not the application [of] a statute created by Congress.''); *Malkan FM Associates* v. *FCC,* 935 F.2d 1313 (D.C. Cir. 1991) (agency not required to publish in the **Federal Register** notices that radio tower height limit near Mexican border was lower than that prescribed by Federal Communication Commission's (FCC's) general rules; limit on tower height near border was set by international agreement and not by ''rule'' of the FCC).

D. Comments Regarding Impacts on Specific Communities

The Treasury Department and the IRS received several comments on the potential impact of the proposed regulations on specific communities, including Tribal communities, low-income communities, and other communities with environmental justice concerns. The Treasury Department and the IRS take seriously concerns expressed by comments that relate to issues of environmental justice, consistent with the directives contained in previously issued Executive Orders. *See,* for example, E.O. 14096, *Revitalizing Our Nation's Commitment for Environmental Justice for All,* (88 FR 25251, April 21, 2023) and E.O. 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* (59 FR 7629, February 16, 1994).

One comment stated that hydrogen projects were often developed without consent from or consideration of or toward impacted communities, including Tribes. The comment recommended that the Treasury Department and the IRS implement a rule that requires taxpayers that claim the section 45V credit to show that they obtained consent from impacted communities, including Tribal nations, and that such consent was freely given prior to the start of any projects. Requiring applicants to show free, prior, and informed consent would reduce harms and the loss of resources that result from such subsidized hydrogen production, according to the comment.

Other comments noted that the regulations might affect the hydrogen industry in ways harmful to certain communities, by incentivizing dirty production in those communities, increasing demand for water, or by failing to provide full incentives to hydrogen production that could be produced in certain communities, like so-called ''blue'' hydrogen. A comment suggested that the U.S. government is failing its trust responsibility with a particular Tribe by discouraging the production of blue hydrogen, which the comment states is a Tribal trust asset.

The final regulations do not adopt these comments. Unlike some other IRA provisions, section 45V does not include rules that target investment in particular communities, on Indian land, or in any other specified geography. *Compare* section 45(b)(11) (relating to an increase in the production tax credit for qualified facilities located in energy communities), section 48(a)(14) (relating to increased investment tax credit rate for energy projects placed in service in energy communities), section 48(e) (relating to special rules for certain solar and wind facilities placed in service in connection with low-income communities), section 45Y(g)(7) (relating to an increase in the clean energy production credit for qualified facilities located in energy communities), section 48E(a)(3)(A) (relating to an increase in credit rate of the clean electricity investment credit for qualified facilities or energy storage technologies placed in service in energy communities), and section 48E(h) (relating to special rules for the clean electricity investment credit for certain facilities placed in service in connection with low-income communities).

Nor does section 45V provide rules to specifically require a taxpayer to obtain the consent of impacted communities, or rules that would provide additional incentives for activity in those communities. Such regulation of actions between private parties related to the process for the production of clean hydrogen is not specifically authorized in section 45V. Moreover, for the reasons described in this Summary of Comments and Explanation of Revisions, these final regulations provide appropriate rules for clean hydrogen production regarding adequate safeguards, emissions determinations, and verification, consistent with the statute. With respect to comments stating concern regarding the lower section 45V credit amount for the production of certain types of qualified clean hydrogen, the statutory text of section 45V(b) unambiguously provides the applicable amount and applicable percentage for the section 45V credit, which is based on lifecycle GHG emissions rates.

With respect to Tribes, the Treasury Department and the IRS will continue to consider issues that may affect Tribes and Tribal stakeholders, including, for example, whether Tribes may regulate GHG emissions and how such regulations may affect the emissions determinations for qualified clean hydrogen.

VIII. Applicability Date

These final regulations apply to taxable years beginning after December 26, 2023, the date the proposed regulations were published in the **Federal Register**. For taxable years beginning after December 31, 2022, and on or before December 26, 2023, taxpayers may choose to apply the rules of §§ 1.45V–1, –2, and –4 through –6, provided that taxpayers apply the rules in their entirety and in a consistent manner.

One comment requested clarification on the applicability date of these final regulations for facilities that were placed in service prior to the effective date of these final regulations. As provided in the Explanation of Provisions to the proposed regulations, taxpayers may choose to rely upon the proposed regulations for taxable years beginning after December 31, 2022, and before the date these final regulations are published in the **Federal Register**, provided that taxpayers follow the proposed regulations in their entirety and in a consistent manner. Also, as provided in the preceding paragraph, taxpayers may choose to apply the final rules of §§ 1.45V–1, –2, and –4 through –6, provided that taxpayers apply the rules in their entirety and in a consistent manner.

IX. Severability

If any provision in this rulemaking is held to be invalid or unenforceable facially, or as applied to any person or circumstance, it shall be severable from the remainder of this rulemaking, and shall not affect the remainder thereof, or the application of the provision to other persons not similarly situated or to other dissimilar circumstances.

Effect on Other Documents

None.

Special Analyses

I. Regulatory Planning and Review

Pursuant to the Memorandum of Agreement, Review of Treasury Regulations under Executive Order 12866 (June 9, 2023), tax regulatory actions issued by the IRS are not subject to the requirements of section 6 of Executive Order 12866, as amended. Therefore, a regulatory impact assessment is not required.

II. Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3501–3520) (PRA) generally

requires that a Federal agency obtain the approval of the Office of Management and Budget (OMB) before collecting information from the public, whether such collection of information is mandatory, voluntary, or required to obtain or retain a benefit. A Federal agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the collection of information displays a valid control number.

The collections of information in these final regulations contain reporting, third-party disclosure, and recordkeeping requirements. These collections are necessary for taxpayers to claim the section 45V credit, or the section 48 credit with respect to a specified clean hydrogen production facility, and for the IRS to validate that taxpayers have met the regulatory requirements and are entitled to claim either credit.

The recordkeeping requirements in these final regulations include the requirement that taxpayers claiming the section 45V credit, or the section 48 credit with respect to a specified clean hydrogen production facility, need to meet the general recordkeeping provisions under section 6001 necessary to substantiate the amount of the section 45V credit or section 48 credit claimed by the taxpayer as detailed in proposed §§ 1.45V–2(c) and 1.48–15(g). These recordkeeping requirements are considered general tax records under § 1.6001–1(e). For PRA purposes, general tax records are already approved by OMB under 1545–0074 for individuals/sole proprietors, 1545–0123 for business entities, and 1545–0047 for tax-exempt organizations, and 1545–0092 for trust and estate filers.

The final regulations reference the DOE's process for applicants to request an emissions value from the DOE that can then be used to file a petition with the Secretary for a PER determination as detailed in proposed § 1.45V–4. The petition made to IRS will be performed by attaching the emissions value obtained from the DOE to the filing of Form 7210, *Clean Hydrogen Production Credit.* The burden for these requirements is included within the Form and Instructions for 7210. Form 7210 was approved by OMB, in accordance with 5 CFR 1320.10, under the following OMB Control Numbers: 1545–0074 for individuals, 1545–0123 for businesses, 1545–0047 for tax-exempt organizations, and 1545–2321 for trust and estate filers.

The final regulations mention the collection of information associated with the process for taxpayers to request an emissions value from the DOE, which is reflected in the Treasury Department and IRS's Paperwork Reduction Act Supplemental NPRM dated April 11, 2024 (89 FR 29551), relating to such process. The OMB approved the DOE's Submission related to the DOE's emissions value request process on September 27, 2024, under Control Number 1910–5208. These final regulations are not creating or changing any of the collection requirements approved by OMB under Control Number 1910–5208.

The final regulations include reporting requirements that taxpayers claiming the section 45V credit provide a verification report with their annual Federal income tax return or information return for each taxable year in which they claim the section 45V credit as detailed in proposed § 1.45V–5. The final regulations also include a third-party disclosure requirement that a verification report must be certified by an unrelated third party. The verification report must contain an attestation regarding the taxpayer's production of qualified clean hydrogen for sale or use, the amount of qualified clean hydrogen sold or used by the taxpayer, conflicts of interest, the verifier's qualifications, and documentation necessary to substantiate the verification process. The taxpayer must submit the verification report to the IRS by attaching it to Form 7210, or any successor form(s). The burden for these requirements is included within the Form and Instructions for Form 7210. Form 7210 was approved by OMB, in accordance with 5 CFR 1320.10, under the following OMB Control Numbers: 1545–0074 for individuals, 1545–0123 for businesses, 1545–0047 for tax-exempt organizations, and 1545–2321 for trust and estate filers.

The final regulations include reporting, third-party disclosure, and recordkeeping requirements that taxpayers making the election under section 48(a)(15) to claim the energy credit under section 48 with respect to a specified clean hydrogen production facility. The reporting requirement is that taxpayers submit an annual verification report with their Federal income tax return or information return for the year in which they claim the section 48 credit. The third-party disclosure requirement is that the annual verification report must be certified by an unrelated third-party. The annual verification report must contain an attestation regarding the taxpayer's production of qualified clean hydrogen for sale or use during the taxable year, the amount of such qualified clean hydrogen sold or used by the taxpayer, conflicts of interest, the verifier's qualifications, the lifecycle GHG emissions rate of the hydrogen that the specified clean hydrogen production facility produced, and documentation necessary to substantiate the verification process. The final regulations also include a requirement that the taxpayer obtain and retain an annual verification report for each taxable year of the recapture period. The taxpayer must obtain the annual verification report by the return filing due date (including extensions) for the taxable year to which the annual verification report relates. The annual verification report for the taxable year in which the section 48(a)(15) election is made will be attached to Form 3468, *Investment Credit.* The annual verification report for each taxable year of the recapture period will be retained by the taxpayer for at least six years after the due date (including extensions) for filing the Federal income tax return or information return for the year to which the report relates. The burden for these requirements is included within the Form and Instructions for Form 3468. The revisions to Form 3468 have been approved by OMB, in accordance with 5 CFR 1320.10, under the following OMB Control Numbers: 1545–0074 for individuals, 1545–0123 for businesses, 1545–0047 for tax-exempt organizations, and 1545–0155 for trust and estate filers.

No public comments were received by the IRS directed specifically at the PRA or on the collection requirements, but comments generally articulated the burdens associated with the documentation requirements in the proposed regulations. As described in the relevant portions of this preamble, the Treasury Department and the IRS have determined that the documentation requirements are necessary to administer the provisions of sections 45V and 48(a)(15).

III. Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) (RFA) imposes certain requirements with respect to Federal rules that are subject to the notice and comment requirements of section 553(b) of the Administrative Procedure Act (5 U.S.C. 551 *et seq.*) and that are likely to have a significant economic impact on a substantial number of small entities. Unless an agency determines that a proposal is not likely to have a significant economic impact on a substantial number of small entities, section 603 of the RFA requires the agency to present a final regulatory flexibility analysis (FRFA) of the final regulations. The Treasury Department

and the IRS have not determined whether the final regulations will likely have a significant economic impact on a substantial number of small entities. This determination requires further study. Because there is a possibility of significant economic impact on a substantial number of small entities, a FRFA is provided in these final regulations.

Pursuant to section 7805(f) of the Code, the proposed regulations were submitted to the Chief Counsel of the Office of Advocacy of the Small Business Administration (SBA) for comment on their impact on small business, and no comments were received.

A. Need for and Objectives of the Rule

The final regulations provide guidance to taxpayers intending to claim the section 45V credit for the production of qualified clean hydrogen or make the election under section 48(a)(15) to treat qualified property that is part of a specified clean hydrogen production facility as energy property and claim the section 48 credit. The final regulations provide needed guidance for taxpayers on use of the 45VH2–GREET model to determine the lifecycle GHG emissions rate resulting from the hydrogen production process, procedures for petitioning the Secretary for a PER determination, requirements for the verification of the production and sale or use of the hydrogen, requirements for modifications to an existing hydrogen production facility, and procedures for making the election under section 48(a)(15).

B. Affected Small Entities

The RFA directs agencies to provide a description of, and if feasible, an estimate of, the number of small entities that may be affected by the proposed rules, if adopted. The SBA's Office of Advocacy estimates in its 2023 Frequently Asked Questions that 99.9 percent of American businesses meet the definition of a small business. The applicability of these final regulations does not depend on the size of the business, as defined by the SBA.

As described more fully in the Summary of Comments and Explanation of Revisions to this final regulation and in this FRFA, sections 45V and 48(a)(15) and these final regulations may affect a variety of different businesses across several different industries. Because the potential credit claimants can vary widely, it is difficult to estimate at this time the impact of these final regulations, if any, on small businesses. Although there is uncertainty as to the exact number of small businesses within this group, the current estimated number of respondents to these final regulations is between 400 and 600 taxpayers. Based on further analysis of announced clean hydrogen projects and the number of projects eligible for the section 45V credit that have registered for elective pay or transferability in the IRS Energy Credits Online portal, the estimated number of entities claiming the section 45V credit has been revised from the 800 to 1,000 taxpayers estimated in the Special Analyses section of the proposed regulations. This revision is not based on any changes made between the proposed regulations and the final regulations.

The Treasury Department and the IRS expect to receive more information on the impact on small businesses when taxpayers start using the guidance and procedures provided in these final regulations to claim the section 45V credit, or the section 48 credit with respect to a specified clean hydrogen production facility.

C. Impact of the Rules

The final regulations provide rules for how taxpayers can claim the section 45V credit, or the section 48 credit with respect to a specified clean hydrogen production facility. Taxpayers that claim the section 45V credit, or the section 48 credit with respect to a specified clean hydrogen production facility, will have administrative costs related to reading and understanding the rules as well as recordkeeping and reporting requirements because of the verification and Federal income tax return or information return requirements. The costs will vary across different-sized entities and across the type of project(s) in which such entities are engaged.

To claim a section 45V credit, a taxpayer must determine the lifecycle GHG emissions rate for all hydrogen produced at a qualified clean hydrogen production facility during the taxable year. If the hydrogen production technology or feedstock used by the taxpayer to produce hydrogen is addressed in 45VH2–GREET, the taxpayer must use 45VH2–GREET to determine the emissions rate for the hydrogen produced during that taxable year at the qualified clean hydrogen production facility. If the hydrogen production technology or feedstock used by the taxpayer to produce hydrogen is not included in 45VH2–GREET, the taxpayer must petition the Secretary for a provisional emissions rate (PER). As part of the process for a taxpayer to petition for a PER, a taxpayer must submit an application to the DOE for an emissions value that it may use to claim the section 45V credit.

In addition to determining the lifecycle GHG emissions rate for hydrogen produced by the taxpayer at a qualified clean hydrogen production facility during the taxable year, before claiming the section 45V credit, a taxpayer must submit a verification report, certified by an unrelated third party, attesting to the taxpayer's production of qualified clean hydrogen for sale or use, the amount of qualified clean hydrogen sold or used by the taxpayer, conflicts of interest, the verifier's qualifications, and documentation necessary to substantiate the verification process. The process for claiming the section 48 credit with respect to a specified clean hydrogen production facility requires a taxpayer to submit an annual verification report with its Federal income tax return or information return for the taxable year in which it claims the section 48 credit, as well as to obtain an annual verification report for the five taxable years following the taxable year in which the section 48(a)(15) election is made. Additionally, the taxpayer would need to retain records sufficient to establish compliance with these proposed regulations for as long as may be relevant.

Although the Treasury Department and the IRS do not have sufficient data to determine precisely the likely extent of the increased costs of compliance, the estimated burden of complying with the recordkeeping and reporting requirements are described in the PRA section of the Special Analyses to these final regulations.

D. Alternatives Considered

The Treasury Department and the IRS considered alternatives to these final regulations. These final regulations were designed to minimize burdens for taxpayers while ensuring that the statutory requirements of sections 45V and 48(a)(15) are met. For example, in providing rules related to the information required to be submitted to claim the section 45V credit, or the section 48 credit with respect to a specified hydrogen production facility, the Treasury Department and the IRS considered whether the production and sale or use of the hydrogen could be verified by an unrelated party without requiring the unrelated party to possess certain qualifications or conflict of interest characteristics. Such an option would, however, increase the opportunity for fraud or abuse under section 45V or section 48. Section 45V(f) specifically authorizes the IRS to promulgate regulations or other

guidance providing for requirements for recordkeeping or information reporting for purposes of administering the requirements of section 45V. As described in the preamble to these final regulations, these final rules carry out that Congressional intent as the verification requirements allow the IRS to verify the taxpayer's entitlement to the section 45V credit.

Additionally, the Treasury Department and the IRS considered whether to require taxpayers to submit an annual verification report with their Federal income tax returns or information returns claiming the section 45V credit. Section 45V requires the taxpayer to obtain an annual verification report, and the Treasury Department and the IRS determined that requiring the taxpayer to attach such a report to their Federal income tax return or information return is the most efficient way of ensuring the completion and accuracy of the report.

Additionally, the Treasury Department and the IRS considered allowing taxpayers to treat the section 45V credit as determined in the taxable year of hydrogen production or verification. However, such an option would create administrability issues and potentially a mismatch between the taxable year in which the hydrogen is produced and the taxable year in which the section 45V credit for such production is claimed. Thus, the final regulations would require the credit to be determined in the taxable year of production.

E. Duplicative, Overlapping, or Conflicting Federal Rules

The final regulations do not duplicate, overlap, or conflict with any relevant Federal rules. As discussed above, the final regulations merely provide procedures and definitions to allow taxpayers to claim the section 45V credit, or the section 48 credit with respect to a specified clean hydrogen production facility. The Treasury Department and the IRS invite input from interested members of the public on identifying and avoiding overlapping, duplicative, or conflicting requirements.

IV. Unfunded Mandates Reform Act

Section 202 of the Unfunded Mandates Reform Act of 1995 requires that agencies assess anticipated costs and benefits and take certain other actions before issuing a final rule that includes any Federal mandate that may result in expenditures in any one year by a State, local, or Tribal government, in the aggregate, or by the private sector, of $100 million (updated annually for inflation). These final regulations do not include any Federal mandate that may result in expenditures by State, local, or Tribal governments, or by the private sector in excess of that threshold.

V. Executive Order 13132: Federalism

Executive Order 13132 (Federalism) prohibits an agency from publishing any rule that has federalism implications if the rule either imposes substantial, direct compliance costs on State and local governments, and is not required by statute, or preempts State law, unless the agency meets the consultation and funding requirements of section 6 of the Executive order. These final regulations do not have federalism implications and do not impose substantial direct compliance costs on State and local governments or preempt State law within the meaning of the Executive order.

VI. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

Executive Order 13175 (Consultation and Coordination with Indian Tribal governments) prohibits an agency from publishing any rule that has Tribal implications if the rule either imposes substantial, direct compliance costs on Indian Tribal governments, and is not required by statute, or preempts Tribal law, unless the agency meets the consultation and funding requirements of section 5 of the Executive order. This final rule does not have substantial direct effects on one or more federally recognized Indian tribes and does not impose substantial direct compliance costs on Indian Tribal governments within the meaning of the Executive order.

VII. Congressional Review Act

Pursuant to the Congressional Review Act (5 U.S.C. 801 *et seq.*), the Office of Information and Regulatory Affairs has determined that this rule meets the criteria set forth in 5 U.S.C. 804(2).

VIII. Immediate Effective Date

These final regulations have an effective date of January 10, 2025. To the extent that a good cause statement is necessary, the Treasury Department and the IRS find that there would be good cause to make this rule immediately effective upon publication in the **Federal Register**.

Section 45V was added to the Code by the IRA, and generally is applicable for facilities placed in service after December 31, 2022. The provision provides a new tax credit for the production of clean hydrogen produced by a taxpayer at a qualified clean hydrogen production facility during the 10-year period beginning on the date such facility is placed in service. The credit amount is based on the lifecycle GHG emissions rate of the qualified clean hydrogen and is increased for taxpayers satisfying prevailing wage and apprenticeship requirements. The IRA also amended section 48 to provide for an election to treat qualified property which is part of a specified clean hydrogen production facility as energy property for purposes of claiming the section 48 investment tax credit in lieu of the section 45V credit.

Following the enactment of section 45V, many stakeholders and members of Congress expressed the need for prompt guidance on section 45V, in particular to provide investment certainty given that the credit became effective shortly after enactment and expires for facilities beginning construction after December 31, 2032. After publication of the proposed regulations in December 2023, the Treasury Department and the IRS received more than 30,000 comments, reflecting the high level of interest in the provision and the continued expression of a need for certainty. In addition, hydrogen production facilities are capital intensive and require significant lead time to address financial, regulatory, and other issues before such facilities can begin construction. At the time of publication of these final regulations, more than two years have passed from the date that section 45V was enacted. For facilities that were placed in service prior to publication of these final regulations, delaying the effective date of these final regulations would only further delay or hinder their ability to realize the full benefit of the credit. In addition, taxpayers already have been provided notice of the general contents of the rules in the proposed regulations and their proposed applicability to taxable years beginning after December 26, 2023, the date of publication of the proposed regulations. Furthermore, taxpayers have been able to rely on the proposed regulations for taxable years beginning after December 31, 2022, until the date of publication of these final regulations. For these reasons, the Treasury Department and the IRS have determined that an immediate effective date of the final regulations is appropriate to provide certainty to taxpayers and that delaying action on the provisions would disserve taxpayers.

Consistent with Executive Order 14008, ''Tackling the Climate Crisis at Home and Abroad,'' (86 FR 7619, January 27, 2021), letters from Members of Congress urging expeditious

publication of final regulations, and comments' request for finalized rules, the Treasury Department and the IRS have determined that an expedited effective date of the final regulations is appropriate here to provide certainty to taxpayers considering investments to build qualified clean hydrogen production facilities before eligibility for the provisions expires. The final regulations provide needed rules on what the law requires for taxpayers to begin job-generating construction of capital-intensive projects qualifying for section 45V credits. Accordingly, the rules in this Treasury decision will take effect on the date of publication in the **Federal Register**.

Statement of Availability of IRS Documents

Guidance cited in this preamble is published in the Internal Revenue Bulletin and is available from the Superintendent of Documents, U.S. Government Publishing Office, Washington, DC 20402, or by visiting the IRS website at *https://www.irs.gov.*

Drafting Information

The principal authors of these final regulations are James Rider, Courtney Hutson, Alan Tilley, and Glenn Kats, Office of the Associate Chief Counsel (Passthroughs and Special Industries), IRS. However, other personnel from the Treasury Department and the IRS participated in their development.

List of Subjects in 26 CFR Part 1

Income taxes, Reporting and recordkeeping requirements.

Amendments to the Regulations

Accordingly, the Treasury Department and the IRS amend 26 CFR part 1 as follows:

PART 1—INCOME TAXES

■ **Paragraph 1.** The authority citation for part 1 is amended by adding entries in numerical order for §§ 1.45V–1, 1.45V–2, 1.45V–4 through 1.45V–6, and 1.48–15 to read in part as follows:

Authority: 26 U.S.C. 7805 * * *

* * * * *

Section 1.45V–1 also issued under 26 U.S.C. 45V(c)(1)(B) and 45V(f).

Section 1.45V–2 also issued under 26 U.S.C. 45V(c)(1)(B) and 45V(f).

* * * * *

Section 1.45V–4 also issued under 26 U.S.C. 45V(c)(1)(B) and 45V(f).

Section 1.45V–5 also issued under 26 U.S.C. 45V(c)(1)(B) and 45V(f).

Section 1.45V–6 also issued under 26 U.S.C. 45V(c)(1)(B) and 45V(f).

* * * * *

Section 1.48–15 also issued under 26 U.S.C. 48(a)(15)

* * * * *

■ **Par. 2.** Section 1.45V–0 through 1.45V–6 are added to read as follows:

Sec.

* * * * *

* * * * *

§ 1.45V–0 Table of contents.

This section lists the captions contained in §§ 1.45V–1, 1.45V–2, and 1.45V–4 through 1.45V–6.

§ 1.45V–1 Credit for production of clean hydrogen.

(a) Overview—(1) *In general.* For purposes of section 38 of the Internal Revenue Code (Code), the clean hydrogen production credit is determined under section 45V of the Code, so much of sections 6417 and 6418 of the Code that relate to section 45V, and the section 45V regulations (as defined in paragraph (a)(17) of this section). Paragraphs (a)(2) through (17) of this section provide generally applicable definitions of terms that, unless otherwise provided, apply for purposes of section 45V, the section 45V regulations, and any provision of the Code or this chapter that expressly refers to any provision of section 45V or the section 45V regulations. Paragraph (b) of this section provides rules for determining the amount of the section 45V credit for any taxable year, which generally depends on the kilograms of qualified clean hydrogen produced during the taxable year and the emissions intensity of the process used to produce such hydrogen, as well as whether certain requirements, including the requirements under § 1.45V–3, are satisfied. Paragraph (c) of this section provides rules regarding the taxable year for which a section 45V credit is determined. *See* § 1.45V–2 for special rules, including rules to coordinate the section 45V credit with the credit for carbon oxide sequestration determined under section 45Q of the Code, an anti-abuse rule, and recordkeeping requirements. *See* § 1.45V–3 for rules relating to the increased credit amount for satisfying the prevailing wage and apprenticeship requirements. *See* § 1.45V–4 for procedures to determine lifecycle greenhouse gas (GHG) emissions rates for qualified clean hydrogen and § 1.45V–5 for procedures for verification of qualified clean hydrogen production and sale or use. *See* § 1.45V–6 for rules to determine the placed in service date for an existing facility that is modified or retrofitted to produce qualified clean hydrogen. *See also* § 1.48–15 for procedures to elect to treat any qualified property that is part of a specified clean hydrogen production facility as energy property for purposes of section 48 of the Code.

(2) *Applicable amount*—(i) *In general.* The term *applicable amount* means the

amount equal to the applicable percentage of $0.60, provided that if any such amount is not a multiple of 0.1 cent, such amount is rounded to the nearest multiple of 0.1 cent.

(ii) *Inflation adjustment.* The $0.60 amount specified in section 45V(b)(1) and paragraph (a)(2)(i) of this section is adjusted annually by multiplying such amount by the inflation adjustment factor (as determined under section 45(e)(2) of the Code, determined by substituting ''2022'' for ''1992'' in section 45(e)(2)(B)) for the calendar year in which the qualified clean hydrogen is produced, provided that if any such amount as adjusted is not a multiple of 0.1 cent, such amount is rounded to the nearest multiple of 0.1 cent.

(3) *Applicable percentage.* The term *applicable percentage* means the percentage set forth in paragraphs (a)(3)(i) through (iv) of this section, which is determined according to the lifecycle GHG emissions rate of the process by which the qualified clean hydrogen is produced:

(i) In the case of any qualified clean hydrogen that is produced through a process that results in a lifecycle GHG emissions rate of not greater than 4 kilograms of carbon dioxide equivalent (CO_2e) per kilogram of hydrogen, and not less than 2.5 kilograms of CO_2e per kilogram of hydrogen, the applicable percentage is 20 percent.

(ii) In the case of any qualified clean hydrogen that is produced through a process that results in a lifecycle GHG emissions rate of less than 2.5 kilograms of CO_2e per kilogram of hydrogen, and not less than 1.5 kilograms of CO_2e per kilogram of hydrogen, the applicable percentage is 25 percent.

(iii) In the case of any qualified clean hydrogen that is produced through a process that results in a lifecycle GHG emissions rate of less than 1.5 kilograms of CO_2e per kilogram of hydrogen, and not less than 0.45 kilograms of CO_2e per kilogram of hydrogen, the applicable percentage is 33.4 percent.

(iv) In the case of any qualified clean hydrogen that is produced through a process that results in a lifecycle GHG emissions rate of less than 0.45 kilograms of CO_2e per kilogram of hydrogen, the applicable percentage is 100 percent.

(4) *Claim.* With respect to the section 45V credit determined for qualified clean hydrogen produced by the taxpayer at a qualified clean hydrogen production facility, the term *claim* means the filing of a completed Form 7210, *Clean Hydrogen Production Credit,* or any successor form(s), with the taxpayer's Federal income tax return or annual information return for the taxable year in which the credit is determined, and includes the making of an election under section 6417 or 6418 and the regulations in this chapter under section 6417 or 6418, as applicable, with respect to such section 45V credit on the applicable entity's or eligible taxpayer's timely filed (including extensions) Federal income tax return or annual information return.

(5) *Code.* The term *Code* means the Internal Revenue Code.

(6) *DOE.* The term *DOE* means the U.S. Department of Energy.

(7) *Facility*—(i) *In general.* For purposes of the definition of *qualified clean hydrogen production facility* provided at section 45V(c)(3) and paragraph (a)(14) of this section, unless otherwise specified, the term *facility* means a single production line that is used to produce qualified clean hydrogen. For this purpose, a single production line includes all components of property that function interdependently to produce qualified clean hydrogen through a process that results in the lifecycle GHG emissions rate used to determine the credit. Components of property function interdependently to produce qualified clean hydrogen if the placing in service of each component is dependent upon the placing in service of each of the other components to produce qualified clean hydrogen. A facility includes carbon capture equipment if such carbon capture equipment contributes to the lifecycle GHG emissions rate of the process by which the qualified clean hydrogen for which the credit is determined is produced.

(ii) *Treatment of certain indirect production and post-production equipment.* The term *facility* does not include—

(A) Equipment that is used to condition or transport hydrogen beyond the point of production; or

(B) Notwithstanding paragraph (a)(7)(iii) of this section, feedstock-related equipment, including production, purification, recovery, transportation, or transmission equipment; or electricity production equipment used to power the hydrogen production process, including any carbon capture equipment associated with the electricity production process.

(iii) *Multipurpose components.* Components that have a purpose in addition to the production of qualified clean hydrogen may be part of a facility if such components function interdependently with other components to produce qualified clean hydrogen.

(iv) *Example.* The following example illustrates the definition of facility provided in this paragraph (a)(7).

(A) *Facts.* Taxpayer owns a hydrogen production facility that is equipped with carbon capture equipment (as defined in § 1.45Q–2(c)), as distinguished from the carbon capture equipment described in paragraph (a)(7)(ii)(B) of this section. One purpose of this equipment is the capture of carbon oxides. The facility produces hydrogen through a process that results in a lifecycle GHG emissions rate of less than 0.45 kilograms of CO_2e per kilogram of hydrogen. Without the carbon capture equipment, the facility could not produce hydrogen through a process that results in a lifecycle GHG emissions rate of less than 0.45 kilograms of CO_2e per kilogram of hydrogen. Taxpayer determines the section 45V credit using a lifecycle GHG emissions rate of less than 0.45 kilograms of CO_2e per kilogram of hydrogen.

(B) *Analysis.* Because the carbon capture equipment is functionally interdependent with other components of property to produce qualified clean hydrogen through a process that results in the lifecycle GHG emissions rate that Taxpayer uses to determine the credit, the carbon capture equipment is part of the facility for purposes of section 45V(c)(3) and the section 45V regulations, along with all other components of property that function interdependently with the carbon capture equipment to produce such hydrogen.

(8) *Hydrogen gas stream.* The term *hydrogen gas stream* means a flow of gases that includes hydrogen, either alone or with one or more other gases.

(9) *Lifecycle GHG emissions*—(i) *In general.* Subject to section 45V(c)(1)(B) and paragraphs (a)(9)(ii) through(iv) of this section, and unless otherwise specified in the section 45V regulations, the term *lifecycle GHG emissions* has the meaning given the term *lifecycle greenhouse gas emissions* by 42 U.S.C. 7545(o)(1)(H), as in effect on August 16, 2022. For purposes of section 45V, lifecycle GHG emissions include emissions only through the point of production (well-to-gate), as determined under the 45VH2–GREET Model.

(ii) *45VH2–GREET Model.* Unless otherwise specified in the section 45V regulations, for purposes of the section 45V credit, the term 45VH2–GREET Model means the latest publicly available version of 45VH2–GREET developed by Argonne National Laboratory and published by the DOE, as provided in the instructions to the latest version of Form 7210, *Clean*

Hydrogen Production Credit, or any successor form(s), on the first day of the taxable year during which the qualified clean hydrogen for which the taxpayer is claiming the section 45V credit was produced. If a version of 45VH2–GREET becomes publicly available after the first day of the taxable year of production (but still within such taxable year), then the taxpayer may, in its discretion, treat such later version of 45VH2–GREET as the 45VH2–GREET Model.

(iii) *Emissions through the point of production (well-to-gate).* The term *emissions through the point of production (well-to-gate)* means the aggregate lifecycle GHG emissions related to hydrogen produced at a hydrogen production facility during the taxable year through the point of production. It includes emissions associated with growth, gathering, extraction, processing, and delivery of feedstocks to a hydrogen production facility. It also includes the emissions associated with the hydrogen production process, inclusive of the production of a mixed gas or impurity, and the electricity used by the hydrogen production facility and any capture and sequestration of carbon dioxide generated by the hydrogen production facility. Examples of emissions outside of the well-to-gate boundary generally include, but are not limited to, emissions from the liquefaction, storage, or transport of hydrogen.

(iv) *Certain emissions related to purification treated as through point of production.* If the taxpayer knows or has reason to know the purification of a hydrogen gas stream (that is, removal of a mixed gas or impurity) is necessary for a hydrogen gas stream to be productively used, or to be sold for productive use, any lifecycle GHG emissions relating to such purification (for example, emissions from electricity used in purification, or carbon dioxide that is separated from a hydrogen gas stream and then vented as part of purification) are treated as emissions through the point of production (well-to-gate). Additionally, if the taxpayer knows or has reason to know that a hydrogen gas stream contains less than 99 percent hydrogen and will be combusted without purification, any lifecycle GHG emissions relating to the purification needed to purify the hydrogen gas stream to contain 99 percent hydrogen are treated as emissions through the point of production (well-to-gate).

(v) *Example.* The following example illustrates the rule of paragraph (a)(9)(iv) of this section.

(A) *Facts.* Taxpayer is a C corporation that has a calendar year taxable year. In 2025, Taxpayer places Facility in service in the United States. Facility's hydrogen production process produces a hydrogen gas stream containing mixed gases or impurities, and the stream is subsequently sold to Customer without removing the mixed gases or impurities. Taxpayer knows or has reason to know that the purity of the hydrogen gas stream is materially different from what the Customer requires for productive use, and Customer will need to remove the mixed gases or impurities in order for the hydrogen gas stream to be productively used. Because Taxpayer refrains from removing the mixed gases or impurities at the hydrogen production facility, 45VH2–GREET reflects a lower lifecycle GHG emissions rate for the hydrogen production process than it would have reflected had the mixed gases or impurities been removed at Facility.

(B) *Analysis.* The Taxpayer has not accurately reflected well-to-gate emissions in 45VH2–GREET because the emissions associated with purification that was necessary for productive use have not been reflected. All lifecycle GHG emissions relating to the purification of the hydrogen gas stream to be productively used are emissions through the point of production (well-to-gate) and therefore must be taken into account as part of the emissions within the well-to-gate boundary.

(10) *Mixed gas or impurity.* The term *mixed gas or impurity* means a non-hydrogen gas that is part of a hydrogen gas stream.

(11) *Process.* The term *process* means the operations conducted by a facility to produce hydrogen (for example, electrolysis or steam methane reforming) during a taxable year using a primary feedstock. The term *primary feedstock* means a hydrogen-containing chemical that is transformed to produce hydrogen at a hydrogen production facility and has uniform or similar attributes distinguished by the source from which it is derived, if such source materially affects the lifecycle GHG emissions associated with use of the chemical to produce hydrogen.

(12) *Productive use.* The term *productive use* means, with respect to a hydrogen gas stream, a consumption of the hydrogen gas stream in a manner that generates positive economic value, which is determined without regard to the availability of the section 45V credit. The term *productive use* means, with respect to qualified clean hydrogen, a consumption of the qualified clean hydrogen in a manner that generates positive economic value, which is determined without regard to the availability of the section 45V credit.

(13) *Qualified clean hydrogen*—(i) *In general.* The term *qualified clean hydrogen* means hydrogen that is produced through a process that results in a lifecycle GHG emissions rate of not greater than 4 kilograms of CO_2e per kilogram of hydrogen. Such term does not include any hydrogen unless the production and sale or use of such hydrogen is verified by an unrelated party in accordance with, and satisfying the requirements of, § 1.45V–5, and such hydrogen is produced—

(A) In the United States (as defined in section 638(1) of the Code) or a U.S. territory, which, for purposes of section 45V and the section 45V regulations, has the meaning of the term *possession* provided in section 638(2) of the Code;

(B) In the ordinary course of a trade or business of the taxpayer; and

(C) For sale or use.

(ii) *For sale or use.* The term *for sale or use* means for the primary purpose of making ready and available for sale or use. Storage of hydrogen following production does not disqualify such hydrogen from being considered produced for sale or use.

(14) *Qualified clean hydrogen production facility.* The term *qualified clean hydrogen production facility* means a facility—

(i) Owned by the taxpayer;

(ii) That produces qualified clean hydrogen; and

(iii) The construction of which begins before January 1, 2033.

(15) *Secretary.* The term *Secretary* means the Secretary of the Treasury or her delegate.

(16) *Section 45V credit.* The term *section 45V credit* means the credit for production of clean hydrogen determined under section 45V of the Code, so much of sections 6417 and 6418 of the Code that relate to section 45V, and the section 45V regulations.

(17) *Section 45V regulations.* The term *section 45V regulations* means this section, §§ 1.45V–2 through 1.45V–6, and the regulations in this chapter under sections 6417 and 6418 of the Code that relate to the section 45V credit.

(b) *Amount of credit*—(1) *In general.* The amount of the section 45V credit determined under section 45V(a) and the section 45V regulations for any taxable year is the product of the kilograms of qualified clean hydrogen produced by the taxpayer during such taxable year at a qualified clean hydrogen production facility during the 10-year period beginning on the date such facility was originally placed in service, multiplied by the applicable amount with respect to each process used to produce such hydrogen.

(2) *Producer of qualified clean hydrogen.* For purposes of section 45V(a)(1) and paragraph (b)(1) of this section, the term *taxpayer* means the taxpayer that owns the qualified clean hydrogen production facility at the time of the facility's production of hydrogen for which the section 45V credit is claimed, regardless of whether such taxpayer is treated as a producer under section 263A of the Code or under any other provision of law with respect to such hydrogen.

(3) *Increased credit amount for qualified clean hydrogen production facilities.* Pursuant to section 45V(e)(1), § 1.45V–3 provides rules that permit the amount of the section 45V credit determined under section 45V(a) and paragraph (b)(1) of this section to be multiplied by five if certain prevailing wages and apprenticeship requirements are met. *See* § 1.45V–3(a).

(c) *Determination of credit.* Subject to any applicable sections of the Code that may limit the section 45V credit amount, the section 45V credit for any taxable year of a taxpayer who produces qualified clean hydrogen and claims such credit is determined with respect to the qualified clean hydrogen produced by the taxpayer during that taxable year, regardless of whether the verification of the production and sale or use of that hydrogen occurs in a later taxable year. Although the section 45V credit is determined with respect to the taxable year in which the qualified clean hydrogen is produced, a taxpayer is not eligible to claim the section 45V credit with respect to the production of that hydrogen until all relevant verification requirements, and the verification itself, have been completed for both the production of the hydrogen and the sale or use of that hydrogen. Accordingly, although the sale or use of the hydrogen and the verification thereof may occur in a taxable year after the taxable year of production, the section 45V credit is properly claimed with respect to the taxable year of production and is subject to the general period of limitations for filing a claim for credit or refund under section 6511(a) and other applicable provisions of the Code.

(d) *Applicability date.* This section applies to taxable years beginning after December 26, 2023.

1.45V–2 Special rules.

(a) *Coordination with credit for carbon oxide sequestration.* In the case of any qualified clean hydrogen produced at a qualified clean hydrogen production facility that includes carbon capture equipment for which a credit is allowed to any taxpayer under section 45Q of the Code (section 45Q credit) for the taxable year or any prior taxable year, no section 45V credit is allowed under section 45V of the Code. However, if the 80/20 Rule provided in § 1.45Q–2(g)(5) is satisfied with respect to such carbon capture equipment, and no new section 45Q credit has been allowed to any taxpayer for such carbon capture equipment, then the unit of carbon capture equipment (as defined in § 1.45Q–2(c)(3)) for which the 80/20 Rule is satisfied will not be treated as carbon capture equipment for which a section 45Q credit was allowed to any taxpayer for any prior taxable year for purposes of section 45V(d)(2) and this paragraph (a).

(b) *Anti-abuse rule*—(1) *In general.* The rules of section 45V of the Code (and so much of sections 6417 and 6418 of the Code related to the section 45V credit) and the section 45V regulations (as defined in § 1.45V–1(a)(17)) must be applied in a manner consistent with the purposes of section 45V and the section 45V regulations. A purpose of section 45V is to provide taxpayers an incentive to produce qualified clean hydrogen for a productive use. Accordingly, the section 45V credit is not allowable if the primary purpose of the sale or use of qualified clean hydrogen is to obtain the benefit of the section 45V credit in a manner that is wasteful, such as when a taxpayer claims the section 45V credit for qualified clean hydrogen that the taxpayer knows or has reason to know will, in excess of standard commercial practices, be vented, flared, used to produce heat or power that is then directly used to produce hydrogen, or otherwise used to produce hydrogen. For example, venting or flaring for safety or maintenance reasons in the ordinary course of business is a non-abusive commercial industry practice. While not abusive, such venting or flaring is also not a verifiable use under § 1.45V–5(d)(2)(ii), and therefore any such hydrogen that is vented or flared for safety reasons is not eligible for the section 45V credit. A determination of whether the sale or use of qualified clean hydrogen is inconsistent with the purposes of section 45V is based on all relevant facts and circumstances.

(2) *Example.* The following example illustrates the application of paragraph (b)(1).

(i) *Example 1*—(A) *Facts.* Taxpayer is a C corporation that has a calendar year taxable year. In 2031, Taxpayer places Facility in service in the United States. Facility produces qualified clean hydrogen that qualifies for the highest applicable amount of the section 45V credit at a production cost of $2 per kilogram of hydrogen (assuming Taxpayer also claims the increased credit under section 45V(e), excluding any future inflation adjustment, the amount of the section 45V credit would be $3 per kilogram of qualified clean hydrogen). The cost of producing each kilogram of qualified clean hydrogen is less than the amount of the section 45V credit that would be available if Taxpayer qualified for the section 45V credit. In 2031, Taxpayer sells all the qualified clean hydrogen produced at Facility that year to Customer at a price that is well below the current market price. Taxpayer knows or reasonably expects that Customer will vent or flare the qualified clean hydrogen it purchased from Taxpayer, in excess of standard commercial practices. In addition, Taxpayer intends to obtain the benefit of the section 45V credit by claiming such credit itself or monetizing such credit through an election under section 6417 or 6418 of the Code.

(B) *Analysis.* Based on all the facts and circumstances, the primary purpose of Taxpayer's sale of qualified clean hydrogen is to obtain the benefit of the section 45V credit in a manner that is wasteful. Taxpayer is not eligible for the section 45V credit with respect to the qualified clean hydrogen that Taxpayer produced and sold in 2031 to Customer that is subsequently vented or flared by Customer.

(c) *Recordkeeping.* Consistent with section 6001 of the Code, a taxpayer claiming the section 45V credit for qualified clean hydrogen produced at a qualified clean hydrogen production facility must maintain and preserve records sufficient to establish the amount of the section 45V credit claimed by the taxpayer. At a minimum, those records must include records to substantiate the information required to be included in the verification report under § 1.45V–5, records establishing that the facility meets the definition of a qualified clean hydrogen production facility under section 45V(c)(3) and § 1.45V–1(a)(14), records of past credit claims under section 45Q by any taxpayer with respect to carbon capture equipment included at the facility, and records establishing the date the qualified clean hydrogen production facility was placed in service. If the requirements under section 45V(e) and § 1.45V–3(b) for the increased credit amount were satisfied, then the taxpayer must also maintain records in accordance with § 1.45–12. Taxpayers must also retain all raw data used for submission of a request for an emissions value to the DOE for at least six years after the due date (including extensions) for filing the Federal income tax return or information return to which the

provisional emissions rate (PER) (as defined in § 1.45V–4(c)(1)) petition is ultimately attached.

(d) *Applicability date.* This section applies to taxable years beginning after December 26, 2023.

§ 1.45V–4 Procedures for determining lifecycle greenhouse gas emissions rates for qualified clean hydrogen.

(a) *Overview*—(1) *In general.* Except as provided in paragraph (a)(2) of this section, the amount of the section 45V credit is determined under section 45V(a) of the Code and § 1.45V–1(b) according to the lifecycle GHG emissions rate of each hydrogen production process conducted at a hydrogen production facility during the taxable year. The lifecycle GHG emissions rate of each process is determined under the 45VH2–GREET Model. In the case of any hydrogen production pathway, as described in paragraph (c)(2)(i) of this section, for which a lifecycle GHG emissions rate has not been determined under the 45VH2–GREET Model for purposes of section 45V, a taxpayer producing hydrogen via such a pathway may file a petition for a provisional emissions rate (PER) with the IRS for the Secretary's determination of the lifecycle GHG emissions rate with respect to such hydrogen.

(2) *Lifecycle GHG emissions rate of hourly electricity consumption.* In the case of a facility's use of electricity generated on or after January 1, 2030, for which the taxpayer acquires and retires a qualifying EAC (as defined in paragraph (d)(2)(vii) of this section) that represents electricity that is generated in the same hour (Coordinated Universal Time (UTC)) that the taxpayer's process uses electricity to produce hydrogen, the taxpayer may determine the lifecycle GHG emissions associated with the use of such electricity by the taxpayer's process during such hour using the attributes of such qualifying EAC rather than using an annual average of the lifecycle GHG emissions associated with the use of electricity in the taxpayer's process. If a taxpayer determines the lifecycle GHG emissions associated with the use of electricity on an hourly basis in the manner provided in this paragraph (a)(2), such taxpayer must determine the lifecycle GHG emissions associated with the use of electricity on an hourly basis for the entire taxable year. In the case of hydrogen produced at a facility using electricity for which the taxpayer does not acquire and retire qualifying EACs that represent electricity that is generated in the same hour that the taxpayer's hydrogen production facility uses electricity to produce hydrogen on or after January 1, 2030, the lifecycle GHG emissions rate of such hydrogen is determined using the regional annual average emissions rate of such electricity usage as reflected in 45VH2–GREET. The taxpayer may determine the lifecycle GHG emissions associated with the use of electricity on an hourly basis only if the annual average lifecycle GHG emissions rate of the hydrogen production process during the taxable year is not greater than 4 kilograms of carbon dioxide equivalent (CO_2e) per kilogram of hydrogen for all hydrogen produced pursuant to that process during the taxable year.

(3) *Examples.* The following examples illustrate the application of paragraphs (a)(1) and (2) of this section.

(i) *Example 1: Annual emissions accounting*—(A) *Facts.* Taxpayer, which files its Federal income tax return based on the calendar year, owns a hydrogen production facility, Facility, that constantly produces hydrogen through electrolysis during all 24 hours of each day of taxable year 2031. Facility's only inputs are water and electricity. For the first 23 of the 24 hours of each day of 2031, Facility acquires and retires qualifying EACs that represent electricity that is generated in the same hour that the taxpayer's hydrogen production facility uses electricity to produce hydrogen. The qualifying EACs reflect electricity from wind power, a uniform source of zero-emission electricity depicted in 45VH2–GREET. During the last hour of each day in 2031, Facility sources electricity from a regional grid. During taxable year 2031, Taxpayer produces 2,402,145.12 kilograms of a hydrogen gas stream (an annual total of 2,302,055.74 kilograms produced during the first 23 hours of each day, and 100,089.38 kilograms produced during the remaining one hour of each day). To produce such a stream, Facility consumes 132,000 MWh of electricity. Of the 132,000 MWh of electricity consumed, 126,500 MWh of the electricity is from wind power, and 5,500 MWh of the electricity is from the regional electricity grid. On average, of the 2,402,145.12 kilograms produced, 99.99 percent by mol is pure hydrogen and 0.01 percent is water vapor (this translates to 99.9107 percent pure hydrogen and 0.0893 percent water vapor by mass). Thus, Facility produced an annual total of 2,400,000 kilograms of pure hydrogen by mass. In 2031, the Facility produces 10,000,000 kilograms of oxygen co-product. The pressure at which Facility produces the hydrogen gas stream is 300 psi.

(B) *Analysis.* To determine the annual average lifecycle GHG emissions rate of the process by which the 2,400,000 kilograms of pure hydrogen were produced in 2031, Taxpayer must account for the total amount of electricity consumed by Facility in taxable year 2031 (132,000 MWh), the annual average share of electricity that is from each source depicted in 45VH2–GREET (95.8333 percent wind power, 4.1667 percent regional electricity grid), the total amount of hydrogen gas stream produced in that year (2,402,145.12 kilograms), the average share of mixed gases in the hydrogen gas stream over the year (99.99 percent hydrogen by mol, 0.01 percent water by mol), the total amount of oxygen co-product produced in that year (10,000,000 kilograms); and the pressure at which the hydrogen gas stream is produced (300 psi). Assuming that, using these inputs, 45VH2–GREET reflects that the average annual lifecycle GHG emissions rate of the process by which the 2,400,000 kilograms of hydrogen were produced in 2031 not greater than 4 kilograms of CO_2e per kilogram of hydrogen, then the hydrogen produced by Facility in 2031 is qualified clean hydrogen. Further, assuming that, using these inputs, 45VH2–GREET reflects that Facility produces hydrogen through a process that results in an annual lifecycle GHG emissions rate of less than 2.5 but not less 1.5 kilograms of CO_2e per kilogram of hydrogen, the applicable percentage under section 45V(b)(2) is 25 percent. Accordingly, assuming all other requirements to claim the section 45V credit are met, and assuming prevailing wage and apprenticeship requirements under section 45V(e) are met, Taxpayer may claim the section 45V credit for the 2,400,000 kilograms of qualified clean hydrogen in the amount of $1,800,000 (2,400,000 kilograms of qualified clean hydrogen produced by Taxpayer at Facility during taxable year 2031 multiplied by $0.75 with respect to such hydrogen) (unadjusted for inflation).

(ii) *Example 2: Hourly emissions accounting*—(A) *Facts.* The facts are the same as in paragraph (a)(3)(i)(A) of this section (*Example 1*), except that Taxpayer opts to determine the lifecycle GHG emissions rate of electricity used to produce hydrogen on an hourly basis pursuant to paragraph (a)(2) of this section.

(B) *Analysis.* To determine whether Taxpayer is eligible to use hourly accounting, Taxpayer must first complete an analysis on an annual basis, as described in *Example 1.* Assuming that the lifecycle GHG emissions rate associated with pure hydrogen production at Facility during the taxable year is not greater than 4

kilograms of CO2e per kilogram of hydrogen, Taxpayer is eligible to use hourly accounting. To determine the hourly lifecycle GHG emissions rate, Taxpayer must first determine the average share of mixed gases in the hydrogen gas stream over taxable year 2031 (99.99 percent hydrogen by mol, 0.01 percent water vapor by mol) and the average amount of oxygen co-product produced for every kilogram of hydrogen gas stream produced in taxable year 2031 (10,000,000 kilograms of oxygen divided by 2,402,145.12 kilograms of hydrogen gas stream equals 4.163 kilograms of oxygen per kilogram of hydrogen gas stream). Then, for each hour, Taxpayer must account for the following inputs in 45VH2–GREET: the total kilograms of hydrogen gas stream produced in that hour, the product of the annual average oxygen co-product rate (4.163 kilograms of oxygen co-product per kilogram of hydrogen gas stream) and the total kilograms of hydrogen gas stream produced in that hour, the average impurity content of the hydrogen gas stream produced in that hour, the total amount of electricity consumed in that hour, and the source of the electricity used in that hour, as depicted in 45VH2–GREET (for example, wind power, regional electricity grid). Assuming that, using these inputs, 45VH2–GREET reflects that the lifecycle GHG emissions rate of the process by which the hydrogen was produced in each hour of the first 23 hours of each day in taxable year 2031 is less than 0.45 kilograms of CO2e per kilogram of hydrogen, then for purposes of section 45V(b)(2), the applicable percentage for such hydrogen produced in each hour of the first 23 hours of each day of taxable year 2031 is 100 percent. For the hydrogen produced during the last hour of each day of taxable year 2031, assuming that 45VH2–GREET reflects that the lifecycle GHG emissions rate of the process exceeded 4 kilograms of CO2e per kilogram of hydrogen, the applicable percentage for such hydrogen is zero percent (that is, the hydrogen produced is not qualified clean hydrogen). Assuming all other requirements of section 45V are met, including the prevailing wage and apprenticeship requirements of section 45V(e), Taxpayer is entitled to a section 45V credit equal to $3 (not adjusted for inflation) per kilogram of qualified clean hydrogen produced in the first 23 hours of each day of taxable year 2031 and no credit for the hydrogen produced in the last hour of each day of taxable year 2031. As described in *Example 1,* in taxable year 2031, Taxpayer produced 2,400,000 kilograms of pure hydrogen by mass at a constant rate. Accordingly, during the first 23 hours of each day of taxable year 2031, Taxpayer produced 2,300,000 kilograms of pure hydrogen. Taxpayer may therefore claim a section 45V credit of $6,900,000 (2,300,000 kilograms of qualified clean hydrogen produced by Taxpayer during the first 23 hours of each day of taxable year 2031 at Facility multiplied by $3 with respect to such hydrogen).

(b) *Use of the 45VH2–GREET Model*—(1) *In general.* For each taxable year during the period described in section 45V(a)(1), a taxpayer claiming the section 45V credit determines the lifecycle GHG emissions rate of each hydrogen production process conducted at a hydrogen production facility under the 45VH2–GREET Model separately for each process. This determination is made following the close of each such taxable year and, subject to paragraph (a)(2) of this section, must include all of a process's hydrogen production during the taxable year. In using the 45VH2–GREET Model to calculate the lifecycle GHG emissions rate for purposes of determining the amount of the section 45V credit under section 45V(a) and § 1.45V–1(b), the taxpayer must accurately enter all information about its facility requested within the interface of 45VH2–GREET (as described in § 1.45V–1(a)(9)(ii)). Information regarding where taxpayers may access 45VH2–GREET and accompanying documentation will be included in the instructions to the Form 7210, *Clean Hydrogen Production Credit,* or any successor form(s).

(2) *Beginning of construction safe harbor*—(i) *In general.* A taxpayer may, in its discretion, make an irrevocable election effective for the remaining taxable years within the period described in section 45V(a)(1), to treat the latest version of 45VH2–GREET that was publicly available on the date when construction of the qualified clean hydrogen facility began as the 45VH2–GREET Model. In the case of a facility owned by the taxpayer that began construction prior to December 26, 2023, such taxpayer may, in its discretion, make an irrevocable election effective for the remaining taxable years within the period described in section 45V(a)(1), to treat the first publicly-available version of 45VH2–GREET (that is, the version of 45VH2–GREET released in December 2023) as the 45VH2–GREET Model. For purposes of this paragraph (b)(2), in the case of a facility that is modified to produce qualified clean hydrogen under section 45V(d)(4) and § 1.45V–6(a), or a facility that is retrofitted in a manner that entitles the facility to a new placed in service date under § 1.45V–6(b), the date when construction of the facility began is the date when construction of such modification or retrofit began. An election under this paragraph (b)(2)(i) relates to the version of 45VH2–GREET and does not alter any other rules provided in this section and in §§ 1.45V–1, –2, –3, –5, and –6.

(ii) *Time and manner of making election.* The taxpayer makes the election described in paragraph (b)(2)(i) of this section with respect to a qualified clean hydrogen production facility's hydrogen production process on Form 7210 or any successor form(s). The taxpayer must make the election by no later than the due date for filing its Federal income tax return or information return (including extensions) for a taxable period ending no later than December 31, 2025, or the due date for filing its Federal income tax return or information return (including extensions) for the taxable period in which such facility is placed in service, whichever due date is later.

(c) *Provisional emissions rate (PER)*—(1) *In general.* For purposes of section 45V(c)(2)(C) and paragraph (a) of this section, the term *provisional emissions rate* or *PER* means the lifecycle GHG emissions rate of the hydrogen produced through a process at a hydrogen production facility as determined by the Secretary under this paragraph (c).

(2) *Rate not determined*—(i) *In general.* For purposes of section 45V(c)(2)(C), a taxpayer may not file a petition for a PER unless a lifecycle GHG emissions rate has not been determined under the 45VH2–GREET Model with respect to hydrogen produced through a process by the taxpayer at a hydrogen production facility. A lifecycle GHG emissions rate has not been determined under the 45VH2–GREET Model with respect to hydrogen produced through a process by the taxpayer at a hydrogen production facility if either the feedstock used in such process or the facility's hydrogen production technology, together referred to as the facility's ''hydrogen production pathway,'' is not included in the 45VH2–GREET Model. If a taxpayer's request for an emissions value pursuant to paragraph (c)(5) of this section with respect to the hydrogen produced through a process by the taxpayer at a hydrogen production facility is pending at the time such facility's hydrogen production pathway becomes included in an updated version of 45VH2–GREET, the taxpayer's request for an emissions value will be automatically denied. In such case, the taxpayer must

determine the lifecycle GHG emissions rate with respect to such hydrogen under paragraph (c)(2)(ii) of this section.

(ii) *Subsequent inclusion in 45VH2–GREET.* Notwithstanding the definition of the 45VH2–GREET Model provided at § 1.45V–1(a)(9)(ii), for the taxable year in which the hydrogen production facility's hydrogen production pathway is first included in an updated version of 45VH2–GREET, the updated version of 45VH2–GREET will be considered the 45VH2–GREET Model with respect to the hydrogen produced through a process by the taxpayer at the hydrogen production facility during such taxable year, and for purposes of section 45V(c)(2)(C), a lifecycle GHG emissions rate for such hydrogen will be considered to have been determined.

(3) *Process for filing a PER petition.* To file a PER petition with the Secretary, a taxpayer must submit a PER petition attached to the taxpayer's Federal income tax return (or information return) for the first taxable year of hydrogen production ending within the 10-year period described in section 45V(a)(1) for which the taxpayer claims the section 45V credit for hydrogen to which the PER petition relates and for which a lifecycle GHG emissions rate has not been determined, as defined under paragraph (c)(2)(i) of this section. A PER petition must contain the letter received from the DOE stating the emissions value the DOE determined with respect to the facility's hydrogen production pathway, and the control number the DOE assigned to the emissions value request application. If the taxpayer obtained more than one emissions value from the DOE, the PER petition must contain the emissions value setting forth the lifecycle GHG emissions rate of the hydrogen for which the section 45V credit is claimed on the Form 7210, *Clean Hydrogen Production Credit,* or any successor form(s), to which the PER petition is attached.

(4) *PER determination.* Upon the taxpayer's filing of its Federal income tax return (or information return) containing a PER petition in a manner consistent with paragraph (c)(3) of this section, the emissions value of the hydrogen determined by the DOE will be deemed accepted. The taxpayer may rely upon an emissions value provided by the DOE for purposes of calculating and claiming a section 45V credit, provided that any information, representations, or other data provided to the DOE in support of the request for an emissions value are accurate. The IRS's deemed acceptance of such emissions value is the Secretary's determination of the PER. However, the production, including the data the taxpayer submitted in the PER petition and the data provided to the DOE in support of the taxpayer's request for an emissions value, and sale or use of such hydrogen must be verified by an unrelated party under section 45V(c)(2)(B)(ii) and § 1.45V–5. Such verification and any information, representations, or other data provided to the DOE in support of the request for an emissions value are subject to later examination by the IRS.

(5) *Department of Energy (DOE) emissions value request process (EVRP).* An applicant that submits a request for an emissions value must follow the procedures specified by the DOE to request and obtain such emissions value. Emissions values will be evaluated using the same well-to-gate system boundary that is employed in 45VH2–GREET. Additionally, background data parameters in 45VH2–GREET will also be treated as background data (fixed values that an applicant cannot change) in the emissions value request process. Treatment of qualifying EACs and other sources of emissions addressed in the section 45V regulations will be consistently applied in the EVRP. An applicant may request an emissions value from the DOE only after a Class 3 front-end engineering and design (FEED) study or similar indication of project maturity, as determined by the DOE, such as project specification and cost estimation sufficient to inform a final investment decision, has been completed for the hydrogen production facility. The DOE may decline to review applications that are not responsive, including those applications that use a hydrogen production technology and feedstock already in 45VH2–GREET or applications that are incomplete. Applicants seeking a new emissions value for a given hydrogen production facility after the DOE has completed its analysis may reapply only if they wish to resubmit their application with new or revised technical information or clarifications related to the information previously submitted. Guidance and procedures for applicants to request and obtain an emissions value from the DOE will be published by the DOE.

(6) *Effect of PER*—(i) *In general.* A taxpayer may use a PER determined by the Secretary to calculate the amount of the section 45V credit under section 45V(a) and § 1.45V–1(b) with respect to qualified clean hydrogen produced at a qualified clean hydrogen production facility, provided—

(A) The lifecycle GHG emissions rate of such hydrogen has not been determined (for purposes of section 45V(c)(2)(C)) under the 45VH2–GREET Model;

(B) There are no material changes to the information about the taxpayer's hydrogen production process from the information provided to the DOE to obtain an emissions value pursuant to paragraph (c)(5) of this section; and

(C) All other requirements of section 45V are met.

(ii) *Material change.* For purposes of paragraph (c)(6)(i)(B) of this section, a *material change* means any change that would cause a qualified verifier (as defined in § 1.45V–5(h)) to be unable to complete a production attestation under section 45V(c)(2)(B)(ii) of the Code and § 1.45V–5(c).

(iii) *Subsequent inclusion safe harbor*—(A) *In general.* The taxpayer may, in its discretion, make an irrevocable election, effective for the remaining taxable years within the period described in section 45V(a)(1), to treat the first version of 45VH2–GREET that includes the taxpayer's qualified clean hydrogen production facility's hydrogen production pathway as the 45VH2–GREET Model.

(B) *Time and manner of making election.* The taxpayer makes the election described in paragraph (c)(6)(iii)(A) of this section with respect to a qualified clean hydrogen production facility on Form 7210 or any successor form(s). The taxpayer must make the election by no later than the due date for filing its Federal income tax return or information return (including extensions) for a taxable period ending no later than December 31, 2025, or the due date for filing its Federal income tax return or information return (including extensions) for the taxable period in which the taxpayer's qualified clean hydrogen production facility's hydrogen production pathway is first included in 45VH2–GREET, whichever due date is later.

(iv) *Special rule for facilities that receive an emissions value prior to the beginning of construction.* Notwithstanding the requirement of paragraph (c)(6)(i)(A) of this section, a taxpayer who received an emissions value from the DOE with respect to a qualified clean hydrogen production facility (pursuant to paragraph (c)(5) of this section) before the date when construction of the facility began, may, in its discretion, use the PER determined by the Secretary and the associated emissions value to calculate the amount of section 45V credit with respect to qualified clean hydrogen produced at the qualified clean hydrogen production facility for the entirety of the period described in section 45V(a)(1), provided that the

taxpayer continues to satisfy the requirements of paragraphs (c)(6)(i)(B) and (C) of this section.

(v) *Not an examination of books and records.* The Secretary's PER determination is not an examination or inspection of books of account for purposes of section 7605(b) of the Code and does not preclude or impede the IRS (under section 7605(b) or any administrative provisions adopted by the IRS) from later examining a return or inspecting books or records with respect to any taxable year for which the section 45V credit is claimed. For example, the verification report submitted under section 45V(c)(2)(B)(ii) and § 1.45V–5 and any information, representations, or other data provided to the DOE in support of the request for an emissions value are still subject to examination. Further, a PER determination does not signify that the IRS has determined that the requirements of section 45V have been satisfied for any taxable year.

(d) *Use of energy attribute certificates (EACs)*—(1) *In general.* For purposes of the section 45V credit, if a taxpayer determines a lifecycle GHG emissions rate for hydrogen produced at a hydrogen production facility using the 45VH2–GREET Model or the Secretary determines a PER for hydrogen produced at a hydrogen production facility subject to a PER petition, then the taxpayer may treat such hydrogen production facility's use of electricity as being from a specific electricity generating facility rather than as electricity with the annual average lifecycle GHG emissions of the regional electricity grid (as represented in 45VH2–GREET) only if the taxpayer acquires and retires qualifying EACs (as defined in paragraph (d)(2)(vii) of this section) for each unit of electricity that the taxpayer claims from such source. For example, one megawatt-hour of electricity used to produce hydrogen would need to be matched with one megawatt-hour of qualifying EACs. Further, to satisfy this requirement, a taxpayer's acquisition and retirement of qualifying EACs must also be recorded in a qualified EAC registry or accounting system (as defined in paragraph (d)(2)(viii) of this section) so that the acquisition and retirement of such EACs may be verified by a qualified verifier (as defined in § 1.45V–5(h)). The requirements of this paragraph (d)(1) apply regardless of whether the electricity generating facility is grid connected, directly connected, or co-located with the hydrogen production facility.

(2) *Definitions.* For purposes of this section—

(i) *Commercial operations date.* The term *commercial operations date* or *COD* means the date on which a facility that generates electricity begins commercial operations.

(ii) *Energy attribute certificate.* The term *energy attribute certificate* (EAC) means a tradeable contractual instrument, issued through a qualified EAC registry or accounting system (as defined in paragraph (d)(2)(viii) of this section), that represents the energy attributes of a specific unit of energy produced. An EAC may be traded with or separately from the underlying energy it represents. An EAC can be retired by or on behalf of its owner, which is the party that has the right to claim the underlying attributes represented by an EAC. Renewable energy certificates (RECs) and other similar energy certificates issued through a registry or accounting system are forms of EACs.

(iii) *Eligible EAC.* The term *eligible EAC* means an EAC that represents electricity that is produced by an electricity generating facility that is registered on only one qualified EAC registry or accounting system and that, with respect to the electricity to which the EAC relates, provides, at a minimum, the information described in paragraphs (d)(2)(iii)(A) through (H) of this section—

(A) A description of the facility, including the technology and feedstock used to generate the electricity;

(B) The amount and units of electricity;

(C) The COD of the facility that generated the electricity;

(D) For electricity that is generated before January 1, 2030, the calendar year in which such electricity was generated;

(E) For electricity that is generated after December 31, 2029, the date and hour (including time zone, or in UTC) in which such electricity was generated;

(F) Other attributes required by 45VH2–GREET or in the determination of a PER to accurately determine the emissions associated with such electricity;

(G) For electricity generating sources that use carbon capture equipment, the placed in service date of such equipment; and

(H) The project identification number or assigned identifier.

(iv) *Qualifying electricity decarbonization standard.* A *qualifying electricity decarbonization standard* is a standard that—

(A) Contains a target that 100 percent of the State's retail sales of electricity from obligated entities be supplied by renewable, non-emitting, zero-emitting, or minimal-emitting sources, where obligated entities and eligible sources are defined by State policy, or a target for GHG emissions from the State's electricity sector that reflects an equivalent of such a retail sales target, by 2050 or earlier;

(B) Applies to the large majority of eligible electricity supplied to the state, as determined by the State; and

(C) Includes policies that would achieve the target, a requirement that the state develop a plan to achieve the standard, or a requirement that entities subject to the standard are required to develop such a plan.

(v) *Qualifying GHG cap program.* A *qualifying GHG cap program* is a legally binding program that meets the following minimum criteria—

(A) Creates a limitation (cap) on the quantity of GHG emissions from the electricity sector (either alone or along with other sectors) in a State through issuance of a limited number of allowances or other compliance instruments to covered entities for each compliance period;

(B) Includes annual obligations (even if part of multi-year compliance periods) under which an entity subject to the cap must provide information about such entity's GHG emissions and for which an entity must submit at least some compliance instruments to the State's regulatory authority;

(C) Includes a cap on GHG emissions from covered entities that generally declines over time from the cap on GHG emissions in effect in calendar year 2025 (or the first calendar year in which the cap is in effect, if later), with adjustments as appropriate for expansions in the scope of the cap;

(D) Applies to the large majority of in-state electricity sources of emissions that emit greater than 25,000 metric tons of CO2e in a calendar year;

(E) Applies to the large majority of out-of-state electricity supplied to the State and to emissions associated with those imports, including emissions that arise from entities that emit greater than 25,000 metric tons of CO2e in a calendar year;

(F) Generally ensures that the prices of allowances sold in a state-run auction cannot fall below $25 per metric ton of CO2e, adjusted for inflation from 2025 dollars using at a minimum the most recently available twelve-month value of the Consumer Price Index for All Urban Consumers (CPI–U), as published by the United States Bureau of Labor Statistics (BLS); and

(G) Generally ensures that the cap on greenhouse gas emissions cannot be exceeded for less than $90 per metric ton of CO2e, adjusted for inflation from 2025 dollars using at a minimum the

most recently available twelve-month value of the CPI–U, as published by the BLS.

(vi) *Merchant nuclear reactor.* The term *merchant nuclear reactor* means a nuclear reactor that competes in a competitive electricity market through the sale of energy and, in some cases, other services and for which over 50 percent of the reactor and its electricity production does not receive cost recovery through rate regulation or public ownership with related retail rate recovery.

(vii) *Qualifying EAC.* The term *qualifying EAC* means an eligible EAC that meets the requirements of paragraph (d)(3) of this section and for which the satisfaction of those requirements has been verified by a qualified verifier (as defined in § 1.45V–5(h)).

(viii) *Qualified EAC registry or accounting system.* The term *qualified EAC registry or accounting system* means a tracking system that—

(A) Assigns a unique identification number to each EAC tracked by such system;

(B) Enables verification that only one EAC is associated with each unit of electricity;

(C) Verifies that each EAC is claimed and retired only once;

(D) Identifies the owner of each EAC; and

(E) Provides a publicly accessible view (for example, through an application programming interface) of all currently registered generators in the tracking system to prevent the duplicative registration of generators.

(ix) *Region.* The term *region* means a Region that corresponds to a Balancing Authority, as identified in the following table. Alaska, Hawaii, and each U.S. territory will be treated as separate regions. Future versions of this table may be provided as a safe harbor in guidance published in the *Internal Revenue Bulletin.*

TABLE 1 TO PARAGRAPH (d)(2)(ix)

Balancing Authority	Region
Balancing Authority of Northern California	California.
California Independent System Operator (Balancing Authority)	California.
Imperial Irrigation District	California.
Los Angeles Dept of Water & Power	California.
Turlock Irrigation District	California.
Midcontinent ISO (Balancing Authority): South	Delta.
Duke Energy Florida Inc	Florida.
Florida Municipal Power Pool	Florida.
Florida Power & Light	Florida.
Gainesville Regional Utilities	Florida.
Homestead (City of)	Florida.
JEA	Florida.
New Smyrna Beach Utilities Commission	Florida.
Reedy Creek Improvement District	Florida.
Seminole Electric Coop Inc	Florida.
Tallahassee FL (City of)	Florida.
Tampa Electric Co	Florida.
East Kentucky Power Coop Inc	Mid-Atlantic.
LG&E & KU Services Co	Mid-Atlantic.
Ohio Valley Electric Corp	Mid-Atlantic.
PJM Interconnection	Mid-Atlantic.
Associated Electric Coop Inc	Midwest.
Electric Energy Inc	Midwest.
Gridliance Heartland	Midwest.
Midcontinent ISO (Balancing Authority): North and Central	Midwest.
NaturEner Power Watch LLC (GWA)	Mountain.
NaturEner Wind Watch LLC	Mountain.
Nevada Power Co	Mountain.
Northwestern Energy	Mountain.
PacifiCorp East	Mountain.
Public Service Co of Colorado	Mountain.
WAPA Rocky Mountain Region	Mountain.
WAPA Upper Great Plains West	Mountain.
New England ISO (Balancing Authority)	New England.
Northern Maine	New England.
New York ISO (Balancing Authority)	New York.
Avangrid Renewables LCC	Northwest.
Avista Corp	Northwest.
Bonneville Power Administration	Northwest.
Gridforce Energy Management LLC	Northwest.
Idaho Power Co	Northwest.
PacifiCorp West	Northwest.
Portland General Electric	Northwest.
PUD No 1 of Chelan County	Northwest.
PUD No 1 of Douglas County	Northwest.
PUD No 2 of Grant County	Northwest.
Puget Sound Energy Inc	Northwest.
Seattle City Light	Northwest.
Tacoma Power	Northwest.
Southwest Power Pool (Balancing Authority)	Plains.
Southwestern Power Administration	Plains.
Alcoa Power Generating Inc Yadkin Division	Southeast.

TABLE 1 TO PARAGRAPH (d)(2)(ix)—Continued

Balancing Authority	Region
Duke Energy Carolinas LLC	Southeast.
Duke Energy Progress East	Southeast.
Duke Energy Progress West	Southeast.
PowerSouth Energy Coop	Southeast.
South Carolina Electric & Gas Co	Southeast.
South Carolina Public Service Authority	Southeast.
Southeastern Power Administration (Southern)	Southeast.
Southern Co Services Inc	Southeast.
Tennessee Valley Authority	Southeast.
Arizona Public Service Co	Southwest.
Arlington Valley LLC	Southwest.
El Paso Electric	Southwest.
Gila River Power LLC	Southwest.
Griffith Energy LLC	Southwest.
New Harquahala Generating Co LLC	Southwest.
Public Service Co of New Mexico	Southwest.
Salt River Project	Southwest.
Tucson Electric Power Co	Southwest.
WAPA Desert Southwest Region	Southwest.
ERCOT ISO (Balancing Authority)	Texas.

(x) *Qualifying nuclear reactor.* The term *qualifying nuclear reactor* means, with respect to an EAC, a nuclear reactor—

(A) That is a merchant nuclear reactor, as defined in paragraph (d)(2)(vi) of this section, or is a nuclear reactor that is not co-located with any other operating nuclear reactor,

(B) For which the average annual gross receipts within the meaning of section 45U(b)(2)(A)(ii)(I) of the reactor are less than 4.375 cents per kilowatt hour, for any two of the calendar years 2017 through 2021, as determined with respect to any one owner of the reactor, and

(C) That either

(*1*) Has a physical electrical connection with the hydrogen production facility which acquires and retires the EAC, which is on the reactor's side of a utility service meter before the reactor or the hydrogen production facility connect to a distribution or transmission system, or

(*2*) Is the subject of a written binding contract, as defined in paragraph (d)(2)(xi) of this section, for a fixed term of at least 10 years beginning on the first date on which qualified EACs are acquired, under which the owner of the hydrogen production facility agrees to acquire and retire EACs from the nuclear reactor, and which manages the qualifying nuclear reactor's revenue risk.

(xi) *Written binding contract.* For purposes of this paragraph (d)(2)(xi), a contract is a *written binding contract* if it is enforceable under state law against the taxpayer or a predecessor and does not limit damages to a specified amount (for example, by use of a liquidated damages provision). For this purpose, a contractual provision that limits damages to an amount equal to at least five percent of the total contract price will not be treated as limiting damages to a specified amount. For additional guidance regarding the definition of a written binding contract, see § 1.168(k)–2(b)(5)(iii).

(xii) *Qualifying State.* The term *qualifying State* means a state which, as determined by the Secretary, has under its state law or regulations a qualifying electricity decarbonization standard as defined in paragraph (d)(2)(iv) of this section and a qualifying GHG cap program as defined in paragraph (d)(2)(v) of this section. For purposes of this rule, the District of Columbia, Commonwealth of Puerto Rico, Guam, the U.S. Virgin Islands, American Samoa, and the Commonwealth of the Northern Mariana Islands are treated as states.

(3) *Qualifying EAC requirements.* An eligible EAC meets the requirements of this paragraph (d)(3) if it meets the requirements of paragraphs (d)(3)(i) through (iii) of this section.

(i) *Incrementality.* An EAC meets the requirements of this paragraph (d)(3)(i) if it meets the requirements of paragraph (d)(3)(i)(A), (B), (C), or (D) of this section. Paragraph (d)(3)(i)(B)(*4*) of this section provides an example that illustrates the application of paragraph (d)(3)(i)(B) of this section.

(A) *In general.* An EAC meets the requirements of this paragraph (d)(3)(i)(A) if the electricity generating facility that produced the unit of electricity to which the EAC relates has a COD that is no more than 36 months before the hydrogen production facility for which the EAC is retired was placed in service, or, if the electricity represented by the EAC is produced by an electricity generating facility that uses carbon capture and sequestration (CCS) technology, such technology has a placed in service date that is no more than 36 months before the hydrogen production facility for which the EAC is retired was placed in service.

(B) *Uprates*—(*1*) *In general.* An EAC meets the requirements of this paragraph (d)(3)(i)(B) if the electricity represented by the EAC is produced by an electricity generating facility that had an uprate no more than 36 months before the hydrogen production facility with respect to which the EAC is retired was placed in service and such electricity is part of such electricity generating facility's uprated production. The term *uprate* means an increase in an electricity generating facility's rated nameplate capacity (in nameplate megawatts) or capacity measured by a standard other than nameplate capacity (specified capacity) meeting the requirements of the measurement standard described in paragraph (d)(3)(i)(B)(*3*) of this section. The term *pre-uprate capacity* means the nameplate capacity or specified capacity of an electricity generating facility before an uprate. The term *post-uprate capacity* means the nameplate capacity or specified capacity of an electricity generating facility after an uprate. The term *incremental generation capacity* means the increase in an electricity generating facility's rated nameplate capacity or specified capacity from the pre-uprate capacity to the post-uprate capacity. The term *uprated production rate* means the incremental generation

capacity (in nameplate megawatts) divided by the post-uprate capacity (in nameplate megawatts). The term *uprated production* means the uprated production rate of an electricity generating facility multiplied by its total generation output (in megawatt hours). An electricity generating facility's uprated production must be prorated to each hour of such facility's generation by multiplying the production for each hour or each year, consistent with the requirements in paragraph (d)(3)(ii) of this section, by the uprated production rate to determine the electricity to which the uprate relates.

(*2*) *Special rule for restarted facilities.* For purposes of this paragraph (d)(3)(i)(B), a facility that is decommissioned or in the process of decommissioning and restarts can be considered to have increased nameplate or specified capacity from a base of zero if the following conditions are met:

(*i*) The existing facility must have ceased operations;

(*ii*) The existing facility must have a shutdown period of at least one calendar year during which it was not authorized to operate by its respective Federal regulatory authority (that is, the Federal Energy Regulatory Commission (FERC) or the Nuclear Regulatory Commission (NRC));

(*iii*) The increased capacity of the restarted facility must be eligible to restart based on an operating license issued by either FERC or NRC; and

(*iv*) The existing facility must not have ceased operations for the purpose of qualifying for the special rule for restarted facilities.

(*3*) *Measurement standard.* For purposes of paragraph (d)(3)(i)(B)(*1*) of this section, taxpayers must use one of the following measurement standards described in paragraph (d)(3)(i)(B)(*3*)(*i*), (*ii*), or (*iii*) of this section to measure the capacity and change in capacity of a facility, except a taxpayer cannot use the measurement standard described in paragraph (d)(3)(i)(B)(*3*)(*ii*) of this section if the taxpayer is able to use the measurement standard described in paragraph (d)(3)(i)(B)(*3*)(*i*) of this section:

(*i*) Modified or amended facility operating licenses from FERC or NRC, or related reports prepared by FERC or NRC as part of the licensing process;

(*ii*) The International Standard Organization (ISO) conditions to measure the nameplate capacity of the facility consistent with the definition of nameplate capacity provided in 40 CFR 96.202; or

(*iii*) A measurement standard prescribed by the Secretary in guidance published in the Internal Revenue Bulletin (see § 601.601 of this chapter).

(*4*) Example. The following example illustrates the application of paragraph (d)(3)(i)(B) of this section.

(*i*) *Facts.* Power Plant undergoes an uprate that expands its rated nameplate capacity from a pre-uprate capacity of 10 megawatts (MW) to a post-uprate capacity of 12 MW. After the uprate, its generation output increases to a total of 40,000 megawatt hours (MWh) for the year.

(*ii*) *Analysis.* Power Plant's incremental generation capacity is 2 MW, its uprated production rate is 0.167 (2 MW divided by 12 MW), and its total uprated production for the year is 6,667 MWh (2 MW divided by 12 MW multiplied by 40,000 MWh). Two-twelfths (0.167) of each hour of Power Plant's production may be considered uprated production.

(C) *Electricity produced in qualifying States.* An EAC meets the requirements of this paragraph (d)(3)(i)(C) if the electricity represented by the EAC is produced by an electricity generating facility that is located in a qualifying State, as defined in paragraph (d)(2)(xii) of this section, and the hydrogen production facility acquiring and retiring such EAC is also located in a qualifying State.

(D) *Electricity produced by certain nuclear facilities*—(*1*) *In general.* An EAC meets the requirements of this paragraph (d)(3)(i)(D) if the electricity represented by the EAC is produced by an electricity generating facility that is a qualifying nuclear reactor, as defined in paragraph (d)(2)(x).

(*2*) For purposes of paragraph (d)(3)(i) of this section, only 200 megawatt hours of electricity per operating hour per qualifying nuclear reactor may be considered incremental, except that, if a qualifying nuclear reactor has integrated operations with one or more other qualifying nuclear reactors, the amount of electricity from those integrated reactors deemed incremental shall instead be subject to an aggregate limit of 200 megawatt hours per operating hour multiplied by the number of integrated nuclear reactors that have not permanently ceased operations.

(*3*) A qualifying nuclear reactor is treated as having *integrated operations* with any other qualifying nuclear reactor if the reactors—

(*i*) Are owned by the same or related taxpayers; and

(*ii*) Transmit electricity generated by the reactors through the same point of interconnection or, if the reactors are not grid-connected, or are delivering electricity directly to an end user behind a utility meter, are able to support the same end user, or, if the reactors have multiple points of interconnection, are co-located with each another.

(*4*) For purposes of paragraph (d)(3)(i)(D)(*3*)(*i*) of this section, the term *related taxpayers* means members of a group of trades or businesses that are under common control (as defined in § 1.52–1(b)). Related taxpayers are treated as one taxpayer in determining whether a qualifying nuclear reactor has integrated operations.

(*5*) In the case of a nuclear reactor that satisfies the definition of a qualifying nuclear reactor because it is the subject of a written binding contract as provided in paragraph (d)(2)(x)(C)(*2*) of this section, the megawatt hours of electricity per hour per qualifying nuclear reactor that may be considered incremental are further limited to those megawatt hours of electricity for which the taxpayer acquires EACs from the nuclear reactor pursuant to the written binding contract.

(ii) *Temporal matching*—(A) *In general.* An EAC meets the requirements of this paragraph (d)(3)(ii) if the electricity represented by the EAC is generated in the same hour that the taxpayer's hydrogen production facility uses electricity to produce hydrogen.

(B) *Transition rule.* For EACs that represent electricity generated before January 1, 2030, the EAC will be considered generated in the same hour that the taxpayer's hydrogen production facility uses electricity to produce hydrogen as required in paragraph (d)(3)(ii)(A) of this section if the electricity represented by the EAC is generated in the same calendar year that the taxpayer's hydrogen production facility uses electricity to produce hydrogen.

(C) *Use of energy storage.* For purposes of meeting the requirements of paragraph (d)(3)(ii)(A) of this section, an EAC meets such requirements if the electricity represented by the EAC is discharged from a storage system in the same hour that the taxpayer's hydrogen production facility uses electricity to produce hydrogen. The storage system must be located in the same region as both the hydrogen production facility and the facility generating the stored electricity. To use the rule described in this paragraph (d)(3)(ii)(C), the volume of electricity use substantiated by each EAC representing stored electricity must account for storage-related efficiency losses. In addition, to use the rule described in this paragraph (d)(3)(ii)(C), EACs representing stored electricity must comprehensively address the storage of electricity by reflecting the energy attributes of the electricity

generating facility that provided electricity to the storage facility, reflecting the temporal attributes regarding when the electricity is discharged from energy storage, and ensuring that paragraph (d)(2)(viii)(C) of this section relating to verification that each EAC is claimed and retired only once applies to EACs representing stored electricity.

(iii) *Deliverability*—(A) *In general.* An EAC meets the requirements of this paragraph (d)(3)(iii) if the electricity represented by the EAC is generated by a facility that is in the same region (as defined in paragraph (d)(2)(ix) of this section) as the hydrogen production facility. Whether the electricity generating source and the hydrogen production facility are located in the same region is determined by the balancing authority to which each is electrically interconnected, not the geographic location.

(B) *Interregional delivery.* For purposes of meeting the requirements of paragraph (d)(3)(iii)(A) of this section, an EAC meets such requirements if the electricity generation represented by the EAC has transmission rights from the generator location to the region in which the hydrogen production facility is located and that generation is delivered to (*i.e.,* scheduled and dispatched or settled in) such facility's region. Such delivery must be demonstrated on at least an hour-to-hour basis, with no direct counterbalancing reverse transactions, and must be verified with NERC E-tags or the equivalent. In addition, to use the rule described in this paragraph (d)(3)(iii)(B), the qualified EAC registry or accounting system for each eligible EAC representing delivered electricity must track such delivery. Finally, to use the rule described in this paragraph (d)(3)(iii)(B), in the case of electricity imported from Canada or Mexico, the electricity generator must provide an attestation to the hydrogen production facility for purposes of the verification process described in § 1.45V–5 that the use or attributes of the electricity represented by each EAC are not being claimed for any other purpose.

(e) *Carbon capture and sequestration.* For purposes of the section 45V credit, if a taxpayer determines a lifecycle GHG emissions rate for hydrogen produced at a hydrogen production facility using the 45VH2–GREET Model or the Secretary determines a PER for hydrogen produced at a hydrogen production facility subject to a PER petition, then carbon capture and sequestration may be taken into account only if the carbon capture occurs in the production of qualified clean hydrogen (for subsequent sequestration) or occurs in the production of electricity, fuel, or feedstock that is used by such facility to produce hydrogen and is captured and disposed of in secure geological storage, pursuant to section 45Q(f)(2) and any regulations established thereunder, or utilized in a manner described in section 45Q(f)(5) and any regulations established thereunder. Such carbon capture and sequestration that occurs in the production of qualified clean hydrogen (rather than in the production of electricity, fuel, or feedstock) may only be taken into account if the carbon capture equipment is part of the qualified clean hydrogen production facility.

(f) *Use of methane from certain sources to produce hydrogen*—(1) *In general.* The requirements provided by this paragraph (f) apply to a process (as defined in § 1.45V–1(a)(11)) that uses methane derived from biogas, renewable natural gas (RNG) derived from biogas, or fugitive sources of methane.

(2) *Definitions.* The following definitions apply for purposes of this paragraph (f):

(i) *Alternative fate.* The term *alternative fate* means a set of informed assumptions (for example, production processes, material outcomes, and market-mediated effects) used to estimate the emissions from the use or disposal of each feedstock were it not for the feedstock's new use due to the implementation of policy (that is, to produce hydrogen).

(ii) *Biogas.* The term *biogas* means gas containing methane that results from the decomposition of organic matter under anaerobic conditions.

(iii) *Coal mine methane.* The term *coal mine methane* means methane that is stored within coal seams and is liberated as a result of current or past mining activities. Liberated coal mine methane can be released intentionally by the mine for safety purposes, such as through mine degasification boreholes or underground mine ventilation systems, or it may leak out of the mine through vents, fissures, or boreholes. The term coal mine methane does not include methane removed from virgin coal seams (for example, coal bed methane).

(iv) *Fugitive methane.* The term *fugitive methane* means methane released from equipment leaks or venting during the extraction, processing, transformation, or delivery of fossil fuels and other gaseous fuels to the point of final use.

(v) *Renewable natural gas.* The term *renewable natural gas* (RNG) means biogas that has been upgraded to remove water, CO2, and other impurities such that it is interchangeable with fossil natural gas.

(vi) *Gas energy attribute certificate.* The term *gas energy attribute certificate* (gas EAC) means a tradeable contractual instrument, issued through and retired within a qualified gas EAC registry or accounting system (as defined in paragraph (f)(2)(ix) of this section), that represents the attributes of a specific unit of RNG or coal mine methane. A gas EAC may be traded with or separately from the underlying gas it represents. A gas EAC can be retired by or on behalf of its owner, which is the party that has the right to claim the underlying attributes represented by a gas EAC.

(vii) *Eligible gas EAC.* The term *eligible gas EAC* means a gas EAC that represents the quantity of RNG or coal mine methane that is produced by a producing facility that is registered on only one qualified gas EAC registry or accounting system (as defined in paragraph (f)(2)(ix) of this section) and that, with respect to the RNG or coal mine methane to which the gas EAC relates, provides, at a minimum, the following information:

(A) A description of the production facility, including the technology or practice and feedstock used to produce RNG or coal mine methane;

(B) The amount (and units) of RNG or coal mine methane;

(C) The month and year in which the RNG or coal mine methane is produced;

(D) The location at which the RNG or coal mine methane is injected into a natural gas pipeline (or the location of the production facility if directly used without injection into a natural gas pipeline);

(E) The source or sources of the gas that comprises the RNG or coal mine methane associated with each certificate as well as other attributes required by 45VH2–GREET, or in the determination of a PER, to determine the emissions associated with such RNG or coal mine methane; and

(F) A project identification number or assigned identifier.

(viii) *Qualifying gas EAC.* The term *qualifying gas EAC* means an eligible gas EAC that meets the requirements of paragraph (f)(4)(iii) of this section and for which the satisfaction of those requirements has been verified by a qualified verifier (as defined in § 1.45V–5(h)).

(ix) *Qualified gas EAC registry or accounting system.* The term *qualified gas EAC registry or accounting system* means an electronic tracking system that—

(A) Assigns a unique identification number to each certificate associated

with RNG and coal mine methane tracked by such system;

(B) Requires independent verification of the source or sources of the gas that comprises the RNG or coal mine methane and any other factual considerations relevant to the lifecycle GHG emissions assessment for purposes of section 45V for tracking and verification purposes (self-reported data without independent verification are not allowed);

(C) Requires use of a revenue grade meter, with production volumes reported to the registry via an application programming interface (API) or with independent reporting to ensure accurate accounting for production volumes (self-reported data are not allowed);

(D) Enables verification that only one certificate is associated with each unit of RNG or coal mine methane;

(E) Verifies that each certificate is claimed and retired only once;

(F) Identifies the owner of each certificate and provides for documentation of the chain-of-custody of any transfers of certificates;

(G) Requires an attestation that a producer has not registered the RNG or coal mine methane with other registries;

(H) Provides a publicly accessible view (for example, through an application programming interface) of all currently registered RNG or coal mine methane production facilities in the tracking system to prevent the duplicative registration of such production facilities; and

(I) Requires verification of pipeline interconnection, if applicable.

(3) *Considerations regarding the lifecycle greenhouse gas emissions associated with the production of hydrogen using methane from certain sources*—(i) *In general.* For purposes of determining the lifecycle GHG emissions rate of a process (as defined § 1.45V–1(a)(11)) that uses methane derived from biogas, RNG, or fugitive methane to produce hydrogen, estimates of lifecycle GHG emissions must consider all the direct and significant indirect emissions from the hydrogen production process. Such determinations must consider the alternative fates of that methane, including avoided emissions and alternative productive uses of that methane; the risk that the availability of tax credits creates incentives resulting in the production of additional methane or otherwise induces additional emissions; and observable trends and anticipated changes in waste management and disposal practices over time as they are applicable to methane generation and uses.

(ii) *Methane from landfill sources.* For purposes of determining the lifecycle GHG emissions rate of a process (as defined § 1.45V–1(a)(11)) that uses methane derived from landfill sources, the alternative fate of such gas must be flaring using an efficiency determined by 45VH2–GREET.

(iii) *Methane from wastewater sources.* For purposes of determining the lifecycle GHG emissions rate of a process (as defined § 1.45V–1(a)(11)) that uses methane derived from wastewater sources, the alternative fate of such gas must assume flaring and use the flaring efficiency and other factors as determined by 45VH2–GREET, including accounting for the proportion of the gas typically used to heat the anaerobic digester.

(iv) *Coal mine methane.* For purposes of determining the lifecycle GHG emissions rate of a process (as defined § 1.45V–1(a)(11)) that uses coal mine methane, flaring of such gas must be used as the alternative fate.

(v) *Methane from animal waste.* For purposes of determining the lifecycle GHG emissions rate of a process (as defined § 1.45V–1(a)(11)) that uses methane derived from biogas sourced from animal waste, the emissions associated with producing and transporting such biogas to the point where it is fed into an upgrader must use an alternative fate derived from the national average of all animal waste management practices, which results in a carbon intensity score of –51 grams of CO2e per megajoule (MJ), where the MJ basis refers to the lower heating value of the methane contained in the biogas prior to upgrading.

(vi) *Fugitive methane other than coal mine methane.* For purposes of determining the lifecycle GHG emissions rate of a process (as defined § 1.45V–1(a)(11)) that uses fugitive methane other than coal mine methane, such as fugitive methane from oil and gas operations, productive use of such gas must be used as the alternative fate, which would result in emissions equivalent to the carbon intensity of using fossil natural gas.

(4) *Use of gas EACs*—(i) *In general.* Subject to paragraph (f)(4)(ii) of this section, for purposes of the section 45V credit, if a taxpayer determines a lifecycle GHG emissions rate for hydrogen produced at a hydrogen production facility using the 45VH2–GREET model or the Secretary determines a PER for hydrogen produced at a hydrogen production facility subject to a PER petition, then the taxpayer may treat such hydrogen production facility's use of RNG (as defined in paragraph (f)(2)(v) of this section) or coal mine methane (as defined in paragraph (f)(2)(iii) of this section) as being from a specific source of such gas rather than fossil natural gas only if the taxpayer acquires and retires qualifying gas EACs (as defined in paragraph (f)(2)(viii) of this section) for each unit of such gas that the taxpayer claims from such source. To satisfy this requirement, a taxpayer's acquisition and retirement of qualifying gas EACs must also be recorded in a qualified gas EAC registry or accounting system (as defined in paragraph (f)(2)(ix) of this section) so that the acquisition and retirement of such gas EACs may be verified by a qualified verifier (as defined in § 1.45V–5(h)). The requirements of this paragraph (f)(4) apply regardless of whether the source of the RNG or coal mine methane is connected to a pipeline network, directly connected to a hydrogen production facility, or co-located with the hydrogen production facility.

(ii) *System readiness.* Paragraph (f)(4)(i) of this section applies only if the Secretary determines that one or more electronic tracking systems meet the definition of a qualified gas EAC registry or accounting system (as defined in paragraph (f)(2)(ix) of this section). The Secretary may make this determination no earlier than January 1, 2027. Prior to the Secretary making a determination described in this paragraph (f)(4)(ii), a taxpayer using RNG or coal mine methane in a hydrogen production process must substantiate the use of such gas by maintaining a direct pipeline connection to a supplier of such gas or documentation of other physical methods of exclusive delivery of such gas. Prior to the Secretary making a determination described in this paragraph (f)(4)(ii), a taxpayer must ensure that attributes of the RNG or coal mine methane used in a hydrogen production process are not double counted by obtaining attestations from the RNG or coal mine methane producers that there has been and will be no double counting of such attributes. The taxpayer must provide such attestations to the taxpayer's qualified verifier (as defined in § 1.45V–5(h)).

(iii) *Qualifying gas EAC requirements.* An eligible gas EAC meets the requirements of this paragraph (f)(4)(iii) if it meets the requirements of paragraphs (f)(4)(iii)(A) and (B) of this section.

(A) *Temporal matching.* An eligible gas EAC meets the requirements of this paragraph (f)(4)(iii)(A) if the RNG or coal mine methane represented by the eligible gas EAC was injected into a pipeline described in paragraph

(f)(4)(iii)(B) of this section in the same calendar month that the hydrogen production facility uses the RNG or coal mine methane in the production of hydrogen or, if the RNG or coal mine methane represented by the eligible gas EAC was delivered to the hydrogen production facility from the RNG or coal mine methane producer, through a direct pipeline connection or other physical method of exclusive delivery.

(B) *Deliverability.* An eligible gas EAC meets the requirements of this paragraph (f)(4)(iii)(B) if the RNG or coal mine methane represented by the eligible gas EAC is injected into a natural gas pipeline in the contiguous United States and the hydrogen production facility is also located in and connected to a natural gas pipeline in the contiguous United States. Alaska, Hawaii, and each U.S. territory are separate regions, such that an eligible gas EAC meets the requirements of this paragraph (f)(4)(iii)(B) if the RNG or coal mine methane represented by the eligible gas EAC is injected into a natural gas pipeline in one of these regions and the hydrogen production facility is located in and connected to a natural gas pipeline in the same region. An eligible gas EAC also meets the requirements of this paragraph (f)(4)(iii)(B) if the RNG or coal mine methane represented by the eligible gas EAC was delivered to the hydrogen production facility from the RNG or coal mine methane producer through a direct pipeline connection or other physical method of exclusive delivery.

(g) *Applicability date.* This section applies to taxable years beginning after December 26, 2023.

§ 1.45V–5 Procedures for verification of qualified clean hydrogen production and sale or use.

(a) *In general.* A verification report must be attached to a taxpayer's Form 7210, *Clean Hydrogen Production Credit,* or any successor form(s), with the taxpayer's Federal income tax return or information return for each qualified clean hydrogen production facility and for each taxable year in which the taxpayer claims the section 45V credit.

(b) *Requirements for verification reports.* A verification report specified in paragraph (a) of this section must be prepared by a qualified verifier under penalties of perjury and must contain—

(1) An attestation from the qualified verifier regarding the taxpayer's production of qualified clean hydrogen for sale or use, including an attestation that the inputs used to determine the lifecycle GHG emissions rate of the hydrogen production process are accurate (production attestation);

(2) An attestation from the qualified verifier regarding the amount of qualified clean hydrogen sold or used (sale or use attestation);

(3) An attestation from the qualified verifier regarding conflicts of interest (conflict attestation);

(4) Information regarding the qualified verifier, including documentation of the qualified verifier's qualifications (qualified verifier statement);

(5) Certain general information about the taxpayer's hydrogen production facility where the hydrogen production undergoing verification occurred;

(6) Any documentation necessary to substantiate the verification process given the standards and best practices prescribed by the qualified verifier's accrediting body and the circumstances of the taxpayer and the taxpayer's hydrogen production facility; and

(7) Any other information required by IRS forms or instructions.

(c) *Requirements for the production attestation.* The following requirements apply to the production attestation:

(1) The production attestation must be an attestation, made under penalties of perjury, that the qualified verifier performed a verification sufficient to determine that the operation, during the applicable taxable year, of the hydrogen production facility that produced the hydrogen for which the section 45V credit is claimed, any lifecycle GHG emissions data inputs, and any energy attribute certificates (EACs) applied pursuant to § 1.45V–4(d) for the purpose of accounting for such facility's emissions, are accurately reflected with reasonable assurance in—

(i) The amount of qualified clean hydrogen produced by the taxpayer that is claimed on the Form 7210, *Clean Hydrogen Production Credit,* or any successor form(s), to which the verification report is attached; and

(ii) Either—

(A) The data the taxpayer entered into the 45VH2–GREET Model to determine the lifecycle GHG emissions rate that is claimed on the Form 7210, *Clean Hydrogen Production Credit,* or any successor form(s), to which the verification report is attached; or

(B) The data the taxpayer submitted in the PER petition relating to the hydrogen for which the section 45V credit is claimed, and the data provided to the DOE in support of the taxpayer's request for the emissions value provided in the PER petition.

(2) If the production attestation attests that qualifying EACs were acquired and retired pursuant to § 1.45V–4(d), then the production attestation must confirm that the electricity generator or generators associated with such EACs were not registered on multiple qualifying EAC registries, or, in the event such generators are registered on multiple qualifying EAC registries, that each EAC undergoing verification from each such generator registered on multiple qualifying EAC registries is being issued by only one qualifying EAC registry.

(3) If the production attestation attests to the information specified in paragraph (c)(1)(ii)(B) of this section, then the production attestation must also specify the emissions value received from the DOE that was calculated using such data, expressed in kilograms of carbon dioxide equivalent (CO_2e) per kilogram of hydrogen.

(4) The production attestation must specify the lifecycle GHG emissions rate(s) (expressed in kilograms of CO_2e per kilogram of hydrogen) and the amount of qualified clean hydrogen produced by the taxpayer (expressed in kilograms), that are claimed on the Form 7210, *Clean Hydrogen Production Credit,* or any successor form(s), to which the verification report is attached.

(d) *Requirements for the sale or use attestation*—(1) *In general.* The sale or use attestation must be an attestation, made under penalties of perjury, that the qualified verifier performed a verification sufficient to determine that the amount of qualified clean hydrogen that is specified in the production attestation pursuant to paragraph (c)(1)(i) of this section, and that is claimed on the Form 7210, *Clean Hydrogen Production Credit,* or any successor form(s), to which the verification report is attached, has been sold, or has been used by a person who makes a verifiable use of such hydrogen.

(2) *Verifiable use.* For purposes of section 45V(c)(2)(B)(ii) of the Code and the section 45V regulations (as defined in § 1.45V–1(a)(17)), a person's *verifiable use* of the hydrogen specified in paragraph (d)(1) of this section can occur within or outside the United States. A verifiable use can be made by the taxpayer or a person other than the taxpayer. For example, a verifiable use includes a tolling arrangement pursuant to which a service recipient provides raw materials or inputs, such as water or electricity, to a toller (that is, a third-party service provider that owns a hydrogen production facility), and the toller produces hydrogen for the service recipient using the service recipient's raw materials or inputs in exchange for a fee. In such a case, use of the hydrogen by the service recipient would be a verifiable use. However, a verifiable use does not include—

(i) Use of hydrogen to generate heat or power that is then directly used in the production of more hydrogen (except when such heat or power is derived from a byproduct of hydrogen use); or

(ii) Venting or flaring of hydrogen.

(3) The following example illustrates the application of paragraph (d)(2) of this section.

(i) *Example*—(A) *Facts.* In 2025, Taxpayer A produces 100 kilograms of hydrogen through a process that results in an emissions rate of not greater than four kilograms of CO2e per kilogram of hydrogen produced. However, throughout the year, Taxpayer A feeds two kilograms of the hydrogen back into its facility's process train to replace what would otherwise be externally sourced energy inputs directly supplying the hydrogen production process. Taxpayer A also flares two kilograms of the hydrogen for testing and maintenance purposes. Taxpayer A puts 96 kilograms of the hydrogen to use in a separate facility that produces fertilizer. Additionally, Taxpayer A recovers waste heat from the fertilizer production process to generate electricity used to power both facilities.

(B) *Analysis.* Taxpayer A has made a verifiable use of 96 kilograms of qualified clean hydrogen and may claim the section 45V credit for that amount, assuming all other requirements for claiming the section 45V credit are met. The two kilograms of hydrogen that are flared have not been verifiably used, and therefore Taxpayer A may not determine the section 45V credit with respect to such two kilograms of hydrogen. The two kilograms of hydrogen that are directly supplied back into the hydrogen process have also not been verifiably used because the hydrogen is being consumed to produce heat or power that will then directly be used to produce more hydrogen. Consumption of hydrogen in this manner (to generate heat or power that is then directly used to produce hydrogen) is not a verifiable use under paragraph (d)(2) of this section.

(e) *Requirements for the conflict attestation.* The conflict attestation must include attestations, made under penalties of perjury, that—

(1) The qualified verifier has not received a fee based to any extent on the value of any section 45V credit that has been or is expected to be claimed by any taxpayer and no arrangement has been made for such fee to be paid at some time in the future;

(2) The qualified verifier has not been a party to any transaction in which the taxpayer sold qualified clean hydrogen it had produced or in which the taxpayer purchased inputs for the production of such hydrogen;

(3) The qualified verifier is not related, within the meaning of section 267(b) or 707(b)(1) of the Code, to, or an employee of, the taxpayer;

(4) The qualified verifier is not married to an individual described in paragraph (e)(3) of this section; and

(5) If the qualified verifier is acting in his or her capacity as a partner in a partnership, an employee of any person, whether an individual, corporation, or partnership, or an independent contractor engaged by a person other than the taxpayer, the attestations under paragraphs (e)(1) through (4) of this section must also be made with respect to the partnership or the person who employs or engages the qualified verifier.

(f) *Requirements for the qualified verifier statement.* The qualified verifier statement must include the following—

(1) The qualified verifier's name, address, and taxpayer identification number;

(2) The qualified verifier's qualifications to conduct the verification, including a description of the qualified verifier's education and experience and a photocopy of the qualified verifier's certificate received from their accrediting body;

(3) If the qualified verifier is acting in his or her capacity as a partner in a partnership, an employee of any person, whether an individual, corporation, or partnership, or an independent contractor engaged by a person other than the taxpayer, the name, address, and taxpayer identification number of the partnership or the person who employs or engages the qualified verifier;

(4) The signature of the qualified verifier and the date signed by the qualified verifier; and

(5) A statement that the verification was conducted for Federal income tax purposes.

(g) *General information on the taxpayer's hydrogen production facility.* The verification report must include the following information for the taxpayer's hydrogen production facility where the hydrogen production undergoing verification occurred:

(1) The location of the hydrogen production facility;

(2) A description of the hydrogen production facility, including its method of producing hydrogen;

(3) The type(s) of feedstock(s) used by the hydrogen production facility during the taxable year of production;

(4) The amount(s) of feedstock(s) used by the hydrogen production facility during the taxable year of production; and

(5) A list of the metering devices used to record any data used by the qualified verifier to support the production attestation under paragraph (c) of this section along with a statement that the qualified verifier is reasonably assured that the device(s) underwent industry-appropriate quality assurance and quality control, and the accuracy and calibration of the device has been tested in the last year.

(h) *Qualified verifier.* The term *qualified verifier* means any individual or organization with active accreditation—

(1) From the American National Standards Institute National Accreditation Board to conduct validation and verification in accordance with the requirements of ISO 14065:2020 and ISO 14064–3:2019; or

(2) As a verifier, lead verifier, or verification body under the California Air Resources Board Low Carbon Fuel Standard program.

(i) *Unrelated party.* For purposes of section 45V(c)(2)(B)(ii), the term *unrelated party* means a qualified verifier who meets the requirements of paragraph (e) of this section.

(j) *Requirements for taxpayers claiming both the section 45V credit and the section 45 credit or the section 45U credit.* In the case of a taxpayer who produces electricity for which either the section 45 or section 45U credit is claimed and the taxpayer or a related person uses such electricity to produce hydrogen for which the section 45V credit is claimed, the verification report must also contain attestations that the qualified verifier performed a verification sufficient to determine that—

(1) The electricity used to produce such hydrogen was produced at the relevant facility for which a section 45 or section 45U credit is claimed;

(2) The given amount of electricity (in kilowatt hours) used to produce such hydrogen at the relevant hydrogen production facility is reasonably assured of being accurate; and

(3) The electricity for which a section 45 or section 45U credit was claimed is represented by EACs that are acquired and retired in connection with the production of such hydrogen.

(k) *Timely verification report.* A verification report must be signed and dated by the qualified verifier no later than—

(1) The due date, including extensions, of the Federal income tax return or information return for the

taxable year during which the hydrogen undergoing verification is produced; or

(2) In the case of a credit first claimed for the taxable year on an amended return or administrative adjustment request, the date on which the amended return or administrative adjustment request is filed.

(l) *Applicability date.* This section applies to taxable years beginning after December 26, 2023.

§ 1.45V–6 Rules for determining the placed in service date for an existing facility that is modified or retrofitted to produce qualified clean hydrogen.

(a) *Modification of an existing facility*—(1) *In general.* Under section 45V(d)(4) of the Code, in the case of an existing facility that—

(i) Was originally placed in service before January 1, 2023, and, prior to the modification described in this paragraph (a), did not produce qualified clean hydrogen, and after the date such facility was originally placed in service—

(A) Is modified to produce qualified clean hydrogen; and

(B) Amounts paid or incurred with respect to such modification are properly chargeable to the taxpayer's capital account for the facility,

(ii) Such facility will be deemed to have been originally placed in service as of the date the property required to complete the modification described in this paragraph (a) is placed in service.

(2) *Modification requirements.* For purposes of section 45V(d)(4) and paragraph (a)(1) of this section, an existing facility will not be deemed to have been originally placed in service as of the date the property required to complete the modification is placed in service unless the modification is made for the purpose of enabling the facility to produce qualified clean hydrogen and amounts paid or incurred with respect to the modification are properly chargeable to the taxpayer's capital account. A modification is made for the purpose of enabling the facility to produce qualified clean hydrogen if the facility could not produce hydrogen with a lifecycle GHG emissions rate that is less than or equal to 4 kilograms of carbon dioxide equivalent (CO_2e) per kilogram of hydrogen but for the modification. For example, if a taxpayer solely pays or incurs capital expenses to modify existing components of a hydrogen production facility that are not necessary for the production of hydrogen with a lifecycle GHG emissions rate that is less than or equal to 4 kilograms of CO_2e per kilogram of hydrogen, such modification does not entitle the facility to a new placed in service date. A modification does not include changing fuel inputs to the hydrogen production facility. For example, changing from using conventional natural gas to using renewable natural gas as a feedstock, is not a modification under this paragraph.

(3) *Interaction with 80/20 Rule.* An existing facility that satisfies the requirements of section 45V(d)(4) and paragraphs (a)(1) and (2) of this section is deemed to be originally placed in service as of the date that the property required to complete the modification described in section 45V(d)(4)(B) is placed in service regardless of whether such facility satisfies the requirements of paragraph (b) of this section.

(b) *Retrofit of an existing facility (80/20 Rule).* For purposes of section 45V(a)(1), a retrofitted hydrogen production facility may establish a new date on which it is considered originally placed in service, even though the facility contains some used components of property of a single production line, provided the fair market value of the used property is not more than 20 percent of the facility's total value, calculated by adding the cost of the new property to the value of the used property (80/20 Rule). For purposes of the 80/20 Rule, the cost of new property includes all properly capitalized costs of the new property included within the facility. If a facility satisfies the requirements of the 80/20 Rule, then the date on which such facility is considered originally placed in service for purposes of section 45V(a)(1) is the date on which the new property added to the facility is placed in service.

(c) *Examples.* The following examples illustrate the application of paragraphs (a) and (b) of this section:

(1) *Example 1: Modification of an existing facility*—(i) *Facts.* Facility X, a hydrogen production facility that was originally placed in service on January 1, 2018, could not produce qualified clean hydrogen as described in section 45V(c)(2). After January 1, 2023, Facility X was modified to produce qualified clean hydrogen, and all amounts paid or incurred with respect to such modifications were properly chargeable to the taxpayer's capital account for Facility X. The property required to complete the modification was placed in service on June 1, 2023.

(ii) *Analysis.* Under section 45V(d)(4) and paragraph (a) of this section, because Facility X was originally placed in service before January 1, 2023, and before the modification could not produce qualified clean hydrogen, it is deemed to be originally placed in service as of the date the property required to complete the modification is placed in service. Accordingly, for purposes of section 45V(a)(1) and (d)(4), Facility X is deemed to have been originally placed in service on June 1, 2023.

(2) *Example 2: Modification of an existing facility; coordination with the section 45Q credit previously allowed*—(i) *Facts.* The facts are the same as in paragraph (c)(1) of this section (*Example 1*), except that taxpayer was allowed a section 45Q credit with respect to carbon capture equipment (CCE) included at Facility X before June 1, 2023.

(ii) *Analysis.* Under paragraph (a) of this section and § 1.45V–2(a), although Facility X is deemed to have been originally placed in service on June 1, 2023, because taxpayer had previously been allowed a section 45Q credit with respect to the CCE included at Facility X, no section 45V credit is allowable for qualified clean hydrogen produced at Facility X, despite the modification. The result would be the same if the section 45Q credit with respect to the CCE included at Facility X were allowed to a person other than the taxpayer.

(3) *Example 3: Modification of an existing facility and coordination with section 45Q credit not previously allowed*—(i) *Facts.* Facility Y, a hydrogen production facility that was originally placed in service on February 1, 2020, could not previously produce qualified clean hydrogen as described in section 45V(c)(2). On February 1, 2026, Facility Y was modified to produce qualified clean hydrogen by adding new CCE to allow Facility Y to capture, process, and prepare carbon dioxide for transport for disposal, injection, or utilization. All amounts paid or incurred with respect to such modifications were properly chargeable to the taxpayer's capital account for Facility Y. The property required to complete the modification of Facility Y was placed in service on February 1, 2026, and as a result, Facility Y, including the new CCE, is deemed to be originally placed in service on February 1, 2026, for purposes of sections 45V and 45Q. No section 45Q credit has been allowed to any taxpayer with respect to the new CCE located at Facility Y.

(ii) *Analysis.* Under paragraph (a) of this section and § 1.45V–2(a), because no section 45Q credit has been allowed to any taxpayer with respect to the new CCE located at Facility Y, a section 45V credit is allowable for the qualified clean hydrogen produced at Facility Y, assuming all other requirements of section 45V are met.

(4) *Example 4: Retrofit of an existing facility (80/20 Rule)*—(i) *Facts.* Facility

Z, a hydrogen production facility that was originally placed in service on February 1, 2023, does not produce qualified clean hydrogen as described in section 45V(c)(2). On January 1, 2026, Facility Z was retrofitted to produce qualified clean hydrogen. After the retrofit, the cost of the new property included in Facility Z is greater than 80 percent of Facility Z's total value.

(ii) *Analysis.* Even though Facility Z does not satisfy the requirements of section 45V(d)(4) because Facility Z was not originally placed in service before January 1, 2023, under paragraph (b) of this section, Facility Z is deemed to be originally placed in service on January 1, 2026, because Facility Z meets the 80/20 Rule. Thus, a section 45V credit is allowable for qualified clean hydrogen produced at Facility Z during the 10-year period beginning on January 1, 2026, assuming all other requirements of section 45V are met.

(5) *Example 5: Retrofit of an Existing Facility (80/20 Rule) and coordination with section 45Q credit previously allowed*—(i) *Facts.* The facts are the same as in paragraph (c)(4) of this section (*Example 4*), except that before the retrofit, Facility Z included CCE for which a section 45Q credit was allowed to a taxpayer.

(ii) *Analysis.* Under paragraph (b) of this section and § 1.45V–2(a), Facility Z is deemed to be originally placed in service on January 1, 2026, because Facility Z meets the 80/20 Rule. However, a section 45V credit is not allowable for qualified clean hydrogen produced at Facility Z during the 10-year period beginning on January 1, 2026, because a section 45Q credit has been allowed to a taxpayer with regard to the CCE included in Facility Z.

(d) *Applicability date.* This section applies to taxable years beginning after December 26, 2023.

■ **Par. 3.** Section 1.48–15 is added to read as follows:

§ 1.48–15 Election to treat clean hydrogen production facility as energy property.

(a) *In general.* Under section 48(a)(15) of the Internal Revenue Code (Code), a taxpayer that owns and places in service a specified clean hydrogen production facility (as defined in section 48(a)(15)(C) and paragraph (b) of this section) can make an irrevocable election under section 48(a)(15)(C)(ii)(II) to treat any qualified property (as defined in section 48(a)(5)(D)) that is part of the facility as energy property for purposes of section 48.

(b) *Specified clean hydrogen production facility.* The term *specified clean hydrogen production facility* means any qualified clean hydrogen production facility—

(1) That is placed in service after December 31, 2022;

(2) With respect to which no credit has been allowed under section 45V or 45Q of the Code, and for which the taxpayer makes an irrevocable election to have section 48(a)(15) apply; and

(3) For which an unrelated party has verified in the manner specified in paragraph (e) of this section that such facility produces hydrogen through a process or processes that results in lifecycle GHG emissions that are consistent with the hydrogen that such facility was designed and expected to produce under section 48(a)(15)(A)(ii) and paragraph (c) of this section.

(c) *Energy percentage*—(1) *In general.* In the case of a specified clean hydrogen production facility that is designed and reasonably expected to produce qualified clean hydrogen through a process or processes that results in a lifecycle GHG emissions rate of:

(i) Not greater than 4 kilograms of carbon dioxide equivalent (CO_2e) per kilogram of hydrogen, and not less than 2.5 kilograms of CO_2e per kilogram of hydrogen, the energy percentage is 1.2 percent;

(ii) Less than 2.5 kilograms of CO_2e per kilogram of hydrogen, and not less than 1.5 kilograms of CO_2e per kilogram of hydrogen, the energy percentage is 1.5 percent;

(iii) Less than 1.5 kilograms of CO_2e per kilogram of hydrogen, and not less than 0.45 kilograms of CO_2e per kilogram of hydrogen, the energy percentage is 2 percent; and

(iv) Less than 0.45 kilograms of CO_2e per kilogram of hydrogen, the energy percentage is 6 percent.

(2) *Designed and reasonably expected to produce.* Hydrogen that a facility is *designed and reasonably expected to produce* means hydrogen produced through a process or processes that result in the lifecycle GHG emissions rate specified in the annual verification report described in paragraph (e)(2) of this section for the taxable year in which the election is made. In the case of a facility that is designed and reasonably expected to produce hydrogen through multiple processes, the lifecycle GHG emissions rate must be determined using the weighted average of the lifecycle GHG emissions rates of all hydrogen production processes.

(d) *Time and manner of making the election*—(1) *In general.* To make an election under section 48(a)(15)(C)(ii)(II), a taxpayer must claim the section 48 credit with respect to a specified clean hydrogen production facility on a completed Form 3468, *Investment Credit,* or any successor form(s), and file the form with the taxpayer's Federal income tax return or information return for the taxable year in which the specified clean hydrogen production facility is placed in service. The taxpayer must also attach a statement to its Form 3468, or any successor form(s), filed with its Federal income tax return or information return that includes the information required by the instructions to Form 3468, or any successor form(s), for each specified clean hydrogen production facility subject to an election. A separate election must be made for each specified clean hydrogen production facility that meets the requirements provided in section 48(a)(15) to treat the qualified property that is part of the facility as energy property. If any taxpayer owning an interest in a specified clean hydrogen production facility makes an election under section 48(a)(15)(C)(ii)(II) with respect to the specified clean hydrogen production facility, then that election is binding on all taxpayers that directly or indirectly own an interest in the specified clean hydrogen production facility.

(2) *Special rule for partnerships and S corporations.* In the case of a specified clean hydrogen production facility owned by a partnership or an S corporation, the election under section 48(a)(15)(C)(ii)(II) is made by the partnership or S corporation and is binding on all ultimate credit claimants (as defined in § 1.50–1(b)(3)(ii)). The partnership or S corporation must file a Form 3468, or any successor form(s), with its partnership or S corporation return for the taxable year in which the specified clean hydrogen production facility is placed in service to indicate that it is making the election, and attach a statement that includes all the information required by the instructions to Form 3468, or any successor form(s), for each specified clean hydrogen production facility subject to the election. The ultimate credit claimant must claim the section 48 credit on a completed Form 3468, or any successor form(s), and file such form on a timely filed (including extensions) Federal income tax return for the taxable year in which the ultimate credit claimant's distributive share or pro rata share of the section 48 credit is taken into account under section 706(a) of the Code or section 1366(a) of the Code, respectively. The partnership or S corporation making the election must provide the ultimate credit claimants with the necessary information to

complete Form 3468, or any successor form(s), to claim the section 48 credit.

(3) *Election irrevocable.* The election to treat qualified property that is part of a specified clean hydrogen production facility as energy property is irrevocable.

(4) *Election availability date.* The election to treat qualified property that is part of a specified clean hydrogen production facility as energy property is available for property placed in service after December 31, 2022. In the case of any property placed in service after December 31, 2022, for which construction began before January 1, 2023, the election under section 48(a)(15)(C)(ii)(II) applies only to the extent of the basis of such property that is attributable to construction, reconstruction, or erection occurring after December 31, 2022.

(5) *Beginning of construction safe harbor*—(i) *In general.* A taxpayer may, in its discretion, make an irrevocable election effective for the remaining taxable years within the period described in paragraph (f)(3) of this section, to treat the latest version of 45VH2–GREET that was publicly available on the date when construction of the specified clean hydrogen facility began as the 45VH2–GREET Model. In the case of a facility owned by a taxpayer that began construction prior to December 26, 2023, such taxpayer may, in its discretion, make an irrevocable election effective for the remaining taxable years within the period described in paragraph (f)(3) of this section, to treat the first publicly-available version of 45VH2–GREET (that is, the version of 45VH2–GREET that was released in December 2023) as the 45VH2–GREET Model. For purposes of this paragraph (d)(5), in the case of a facility that is modified to produce qualified clean hydrogen under section 45V(d)(4) or a facility that is retrofitted in a manner that entitles the facility to a new placed in service date under § 1.45V–6(b), the date when construction of the facility began is the date when construction of such modification or retrofit began. An election under this paragraph (d)(5)(i) relates to the version of 45VH2–GREET and does not alter any other rules provided in this section.

(ii) *Time and manner of making election*—(A) *In general.* The taxpayer makes the election described in paragraph (d)(5)(i) of this section with respect to a specified clean hydrogen production facility by attaching a statement to the Form 3468 or any successor form(s). The taxpayer must make the election by no later than the due date for filing its Federal income tax return or information return (including extensions) for the taxable period in which such facility is placed in service.

(B) *Special rule for facilities placed in service prior to January 1, 2024.* In the case of a taxpayer that places in service a specified clean hydrogen production facility prior to January 1, 2024, the taxpayer must make the election described in paragraph (d)(5)(i) of this section by no later than the period of limitation on filing a claim for credit or refund under section 6511(a) for the taxable period in which such facility is placed in service.

(6) *Provisional emissions rate*—(i) *In general.* A taxpayer files a petition with the Secretary for a provisional emissions rate (PER) by following the procedures stated in § 1.45V–4(c)(3) through (5), except, in lieu of attaching the PER petition to the Form 7210 in the first taxable year of production as specified in § 1.45V–4(c)(3), the taxpayer must attach the PER petition to the Form 3468, or a successor form(s), attached to the taxpayer's Federal income tax return for the taxable year in which the specified clean hydrogen production facility is originally placed in service. A taxpayer may use such PER to calculate the amount of the section 48 credit with respect to a specified clean hydrogen production facility, provided—

(A) The lifecycle GHG emissions rate of the hydrogen produced at the specified clean hydrogen production facility has not been determined (for purposes of section 45V(c)(2)(C)) under the 45VH2–GREET Model;

(B) There are no material changes to the information about the taxpayer's hydrogen production process from the information provided to the DOE to obtain an emissions value pursuant to § 1.45V–4(c)(5); and

(C) All other requirements of section 48(a)(15) are met.

(ii) *Material change.* For purposes of paragraph (d)(6)(i)(B), a *material change* means any change that would cause a qualified verifier (as defined in § 1.45V–5(h)) to be unable to complete a verification under paragraph (e) of this section.

(iii) *Subsequent inclusion safe harbor*—(A) *In general.* The taxpayer may, in its discretion, make an irrevocable election, effective for the remaining taxable years within the period described in paragraph (f)(3) of this section, to treat the first version of 45VH2–GREET that includes the taxpayer's specified clean hydrogen production facility's hydrogen production pathway, as described in § 1.45V–4(c)(2)(i), as the 45VH2–GREET Model.

(B) *Time and manner of making election.* The taxpayer makes the election described in paragraph (d)(6)(iii) of this section with respect to a specified clean hydrogen production facility by attaching a statement to the Form 3468 or any successor form(s). The taxpayer must make the election by no later than the due date for filing its Federal income tax return or information return (including extensions) for the taxable period in which such facility is placed in service.

(C) *Special rule for facilities placed in service prior to January 1, 2024.* In the case of a taxpayer that places in service a specified clean hydrogen production facility prior to January 1, 2024, the taxpayer must make the election described in paragraph (d)(6)(iii)(A) of this section by no later than the close of the period of limitation for filing a claim for credit or refund under section 6511(a) for the taxable period in which such facility is placed in service.

(iv) *Special rule for facilities that receive an emissions value prior to the beginning of construction.* Notwithstanding the requirement of paragraph (d)(6)(i)(A) of this section, a taxpayer who received an emissions value from the DOE with respect to a specified clean hydrogen production facility (pursuant to § 1.45V–4(c)(5)) before the date when construction of the facility began, may, in its discretion, continue to use the PER determined by the Secretary and the associated emissions value to calculate the lifecycle GHG emissions rate of the hydrogen produced at the specified clean hydrogen production facility for the remainder of the period described in paragraph (f)(3) of this section, provided that the taxpayer continues to satisfy the requirements of paragraphs (d)(6)(i)(B) and (C) of this section.

(v) *Not an examination of books and records.* The Secretary's PER determination is not an examination or inspection of books of account for purposes of section 7605(b) of the Code and does not preclude or impede the IRS (under section 7605(b) or any administrative provisions adopted by the IRS) from later examining a return or inspecting books or records with respect to any taxable year for which the section 48 credit is claimed. For example, the annual verification report submitted under section 48(a)(15)(C)(iii) and paragraph (e)(2) of this section and any information, representations, or other data provided to the DOE in support of the request for an emissions value are still subject to examination. Further, a PER determination does not signify that the IRS has determined that the requirements of section 48(a)(15),

including the cross-references to section 45V, have been satisfied for any taxable year.

(e) *Third-party verification*—(1) *In general.* In the case of a taxpayer that makes an election under section 48(a)(15)(C)(ii)(II) to treat any qualified property that is part of a specified clean hydrogen production facility as energy property for purposes of the section 48 credit, the taxpayer must obtain an annual verification report for the taxable year in which the election under section 48(a)(15)(C)(ii)(II) is made for the facility and for each taxable year thereafter during the recapture period specified in paragraph (f)(3) of this section. The taxpayer must also submit the annual verification report as an attachment to the Form 3468, or any successor form(s), for the taxable year in which the election under section 48(a)(15)(C)(ii)(II) is made for the facility.

(2) *Annual verification report*—(i) *In general.* For purposes of paragraph (e)(1) of this section, the annual verification report must be signed under penalties of perjury by a qualified verifier (as defined in § 1.45V–5(h)) and contain an attestation providing all of the following—

(A) The information specified in § 1.45V–5(b) and (d) through (h);

(B) A statement attesting to the lifecycle GHG emissions rate of the hydrogen produced through a process (determined under section 45V(c) and § 1.45V–4), or the weighted average of the lifecycle GHG emissions rate of the hydrogen produced through processes, by which all hydrogen was produced at the specified clean hydrogen production facility for the taxable year to which the annual verification report relates and that the operation, during such taxable year, of the specified clean hydrogen production facility, and any qualifying energy attribute certificates applied pursuant to § 1.45V–4(d) for the purpose of accounting for such facility's emissions, are accurately reflected in the data that the taxpayer entered into the 45VH2–GREET Model (as defined in § 1.45V–1(a)(9)(ii)) (or that the taxpayer provided to the Department of Energy (DOE) in support of the taxpayer's request for an emissions value), to determine the lifecycle GHG emissions rate of the hydrogen undergoing verification; and

(C) A statement attesting that the facility produced hydrogen through a process or processes that results in a lifecycle GHG emissions rate that is consistent with, or lower than, the lifecycle GHG emissions rate of the hydrogen that such facility was designed and expected to produce.

(ii) *Inconsistent lifecycle GHG emissions.* In the event the facility produces hydrogen through a process (or processes) that results in a lifecycle GHG emissions rate that is greater than the lifecycle GHG emissions rate that such facility was designed and expected to produce (and thus the qualified verifier cannot provide the attestation specified in paragraph (e)(2)(i)(C) of this section), resulting in a reduced energy percentage under section 48(a)(15)(A)(ii) with respect to such facility, an emissions tier recapture event under paragraph (f)(2) of this section will occur.

(iii) *Designed and expected to produce.* Hydrogen that the facility was *designed and expected to produce* means hydrogen specified in paragraph (c)(2) of this section.

(iv) *Timely annual verification report.* The annual verification report must be signed and dated by the qualified verifier no later than the due date, including extensions, of the Federal income tax return for the taxable year in which the hydrogen undergoing verification was produced.

(v) *Records retention.* In addition to the recordkeeping requirements set forth in paragraph (g) of this section, the taxpayer must retain the annual verification report for at least six years after the due date, with extensions, for filing the Federal income tax return for the taxable year in which the hydrogen undergoing verification was produced.

(f) *Recapture*—(1) *In general.* Pursuant to of section 48(a)(15)(E), in any taxable year of the recapture period specified in paragraph (f)(3) of this section in which an emissions tier recapture event (as defined in paragraph (f)(2) of this section) occurs, the tax imposed on the taxpayer under chapter 1 of the Code for the taxable year of the emissions tier recapture event is increased by the recapture amount specified in paragraph (f)(4) of this section.

(2) *Emissions tier recapture event.* For purposes of paragraph (f)(1) of this section, an *emissions tier recapture event* is any of the following occurrences—

(i) The taxpayer fails to obtain an annual verification report by the deadline for filing its Federal income tax return or information return (including extensions) for any taxable year in which an annual verification report is required under paragraph (e)(1) of this section;

(ii) The specified clean hydrogen production facility actually produced hydrogen through a process (or processes) that results in a lifecycle GHG emissions rate that can only support a lower energy percentage than the energy percentage used to calculate the amount of the section 48 credit for the facility for the taxable year in which the facility is placed in service; or

(iii) The specified clean hydrogen production facility actually produced hydrogen through a process (or processes) that results in a lifecycle GHG emissions rate of greater than 4 kilograms of CO2e per kilogram of hydrogen.

(3) *Recapture period.* For purposes of paragraph (f) of this section, the recapture period begins on the first day of the taxable year after the taxable year in which the facility was placed in service and ends on the close of the fifth taxable year following the close of the taxable year in which the facility was placed in service.

(4) *Recapture amount*—(i) *In general.* In the case of an emissions tier recapture event under paragraph (f)(2) of this section, the *recapture amount* for the taxable year in which the emissions tier recapture event occurred is equal to 20 percent of the excess of the section 48 credit allowed to the taxpayer for the specified clean hydrogen production facility for the taxable year in which the facility was placed in service, over the section 48 credit that would have been allowed to the taxpayer for the facility if the taxpayer had used the energy percentage supported by the actual production to calculate the amount of the section 48 credit.

(ii) *Carrybacks and carryovers.* In the case of any emissions tier recapture event described in paragraph (f)(2) of this section, the carrybacks and carryovers under section 39 must be adjusted by reason of the emissions tier recapture event.

(iii) *Recapture amount in case of recapture events under paragraph (f)(2)(i) or (iii) of this section.* For purposes of paragraph (f)(4)(i) of this section, in the case of an emissions tier recapture event under paragraph (f)(2)(i) or (iii) of this section, the amount of the section 48 credit that would have been allowed to the taxpayer for the specified clean hydrogen production facility if the taxpayer had used the energy percentage supported by the actual production is zero. Accordingly, the recapture amount in the taxable year of an emissions tier recapture event under paragraph (f)(2)(i) or (iii) of this section, is 20 percent of the section 48 credit allowed to the taxpayer for such specified clean hydrogen production facility.

(5) *Example.* The following example illustrates the application of paragraphs (f)(1) through (4) of this section.

(i) *Facts.* On June 1, 2024, Taxpayer, a calendar-year taxpayer, originally

places in service Facility X, a specified clean hydrogen production facility. At such time, Taxpayer's basis in qualified property that is part of Facility X is $100,000,000. In the taxable year in which Facility X was originally placed in service (taxable year 2024), Facility X produces qualified clean hydrogen through a process that results in a lifecycle GHG emissions rate of 0.44kg of CO2e per kilogram of hydrogen. Taxpayer submits with its 2024 Federal income tax return an annual verification report attesting that, for the taxable year 2024, Facility X produced hydrogen through a process that resulted in a lifecycle GHG emissions rate of 0.44kg of CO2e per kilogram of hydrogen, which is consistent with the lifecycle GHG emissions rate of the hydrogen that the facility was designed and expected to produce. Taxpayer makes a valid election under section 48(a)(15)(C)(ii)(II) with respect to Facility X on its Federal income tax return for the taxable year 2024. In the first year of the recapture period (taxable year 2025), Taxpayer fails to obtain an annual verification report by the deadline (including extensions) for filing its 2025 Federal income tax return. In the second year of the recapture period (taxable year 2026), Facility X produces qualified clean hydrogen through a process that results in a lifecycle GHG emissions rate of 1.4kg of CO2e per kilogram of hydrogen and obtains an annual verification report attesting to such lifecycle GHG emissions rate. In the third, fourth, and fifth years of the recapture period (taxable years 2027, 2028, and 2029), Facility X produces qualified clean hydrogen through a process that results in a lifecycle GHG emissions rate of 0.44kg of CO2e per kilogram of hydrogen and obtains an annual verification report attesting to such lifecycle GHG emissions rate, and attesting that such lifecycle GHG emissions rate is consistent with the lifecycle GHG emissions rate of the hydrogen that the facility was designed and expected to produce, by the deadline (including extensions) for filing its 2027, 2028, and 2029 Federal income tax returns, respectively.

(ii) *Analysis.* Facility X is designed and reasonably expected to produce hydrogen through a process that results in a lifecycle GHG emissions rate of 0.44kg of CO2e per kilogram of hydrogen, which is the rate specified in Taxpayer's annual verification report submitted with Taxpayer's Federal income tax return for the taxable year in which the election under section 48(a)(15)(C)(ii)(II) with respect to Facility X was made. Under paragraph (c)(1)(iv) of this section, Facility X's energy percentage is therefore 6 percent. For the taxable year 2024, the year in which Taxpayer places in service Facility X, Taxpayer claims a section 48 credit for its basis in qualified property that is part of Facility X in the amount of $6,000,000 (6 percent of $100,000,000). In taxable year 2025 there is an emissions tier recapture event under paragraph (f)(2)(i) of this section because Taxpayer failed to obtain an annual verification report. Under paragraph (f)(4)(i) of this section, the amount of the section 48 credit recaptured in 2025 is $1,200,000. This reflects 20 percent of the section 48 credit allowed ($6,000,000) for Facility X. In taxable year 2026, there is an emissions tier recapture event under paragraph (f)(2)(ii) of this section because Facility X produced hydrogen through a process that resulted in a lifecycle GHG emissions rate that could only support an energy percentage of 2 percent, which is lower than the energy percentage used to calculate the amount of the section 48 credit for Facility X. Under paragraph (f)(4)(i) of this section, the amount of the section 48 credit recaptured in 2026 is $800,000. This reflects 20 percent of the difference between the amount of the section 48 credit allowed ($6,000,000) and the amount of the section 48 credit that would have been allowed for Facility X if Taxpayer had used the energy percentage supported by the actual production ($2,000,000). There is no emissions tier recapture event in taxable years 2027, 2028, or 2029 because, in those years, Facility X produced hydrogen through a process that resulted in a lifecycle GHG emissions rate that was consistent with the lifecycle GHG emissions rate of the hydrogen that Facility X was designed and expected to produce, and Taxpayer obtained an annual verification report attesting to such by the deadline (with extensions) for filing its Federal income tax return for each of those taxable years.

(6) *Coordination with sections 50(a) and 48(a)(10)(C) of the Code*—(i) *In general.* In each taxable year of the recapture period specified in paragraph (f)(3) of this section for any credit allowed under section 48 with respect to a specified clean hydrogen production facility, the recapture rules, if applicable, apply in the following order:

(A) Section 50(a);

(B) Section 48(a)(10)(C), as provided in § 1.48–13; and

(C) Section 48(a)(15)(E).

(ii) The following examples illustrate the application of paragraph (f)(6) of this section.

(A) *Example 1*—(*1*) *Facts.* The facts are the same as in paragraph (f)(5)(i) of this section (*Example*), except that, in addition to failing to obtain an annual verification report by the deadline (including extensions) for filing its 2025 Federal income tax return, on August 1, 2025, Taxpayer disposes of Facility X. Taxpayer has not been allowed any other credits under section 38.

(*2*) *Analysis.* For taxable year 2025, under section 50(a)(1)(B)(ii), because the period of time between when Facility X was placed in service is more than 1, but less than 2 full years, the applicable recapture percentage is 80 percent. Taxpayer has an increase in tax for taxable year 2025 under section 50(a) of $4,800,000 ($6,000,000 aggregate decrease in credit allowed multiplied by 0.80). Under paragraph (f)(6) of this section, because the credit was recaptured under section 50(a), no further amounts would be recaptured under either section 48(a)(10)(C) (had Taxpayer claimed the increased credit amount under section 48(a)(9)) or section 48(a)(15)(E) (on account of Taxpayer's failure to obtain an annual verification report).

(B) *Example 2*—(*1*) *Facts.* The facts are the same as in paragraph (f)(5)(i) of this section (*Example*), except that, in taxable year 2025, Facility X produces qualified clean hydrogen through a process that results in a lifecycle GHG emissions rate of 1.4 kilograms of CO2e per kilogram of hydrogen and obtains an annual verification report attesting to such lifecycle GHG emissions rate. On August 1, 2026, Taxpayer disposes of Facility X. Taxpayer has not been allowed any other credits under section 38.

(*2*) *Analysis.* In taxable year 2025, there is an emissions tier recapture event under paragraph (f)(2)(ii) of this section because Facility X produced hydrogen through a process that resulted in a lifecycle GHG emissions rate that could only support an energy percentage of 2 percent, which is lower than the energy percentage used to calculate the amount of the section 48 credit for Facility X. Under paragraph (f)(4)(i) of this section, the amount of the section 48 credit recaptured in 2025 is $800,000. In taxable year 2026, under section 50(a)(1)(B)(iii), because the period of time between when Facility X was placed in service is more than 2, but less than 3 full years, the applicable recapture percentage is 60 percent. Taxpayer has an increase in tax under section 50(a) of $3,120,000 ($5,200,000 aggregate decrease in credit allowed

($6,000,000 credit allowed minus $800,000 amount recaptured under paragraph (f)(2)(ii) of this section in taxable year 2025) multiplied by 0.60).

(g) *Recordkeeping.* Consistent with section 6001 of the Code, a taxpayer making the election under section 48(a)(15)(C)(ii)(II) with respect to a specified clean hydrogen production facility must maintain and preserve records sufficient to establish the amount of the section 48 credit claimed by the taxpayer. At a minimum, those records include the annual verification report required under paragraph (e)(2) of this section, records to substantiate the information required to be included in the annual verification report, records establishing that the facility meets the definition of a specified clean hydrogen production facility under section 48(a)(15)(C) and paragraph (b) of this section, records of past credit claims under section 45Q by any taxpayer with respect to carbon capture equipment included at the facility, and records establishing the date the specified clean hydrogen production facility was placed in service. If the increased section 48 credit amount was allowed under section 48(a)(9), then the taxpayer must also maintain records in accordance with § 1.45–12. Taxpayers must also retain all raw data used for submission of a request for an emissions value to the DOE for at least six years after the due date (including extensions) for filing the Federal income tax return or information return to which the provisional emissions rate (PER) (as defined in § 1.45V–4(c)(1)) petition is ultimately attached.

(h) *Applicability date.* This section applies to taxable years beginning after December 26, 2023.

Douglas W. O'Donnell,

Deputy Commissioner.

Approved: December 25, 2024.

Aviva R. Aron-Dine,

Deputy Assistant Secretary of the Treasury (Tax Policy).

[FR Doc. 2024–31513 Filed 1–3–25; 8:45 am]

BILLING CODE 4830–01–P