HCS
HEMP CARBON STANDARD

INDUSTRIAL HEMP BIOCHAR

METHODOLOGY FOR CO2 REMOVAL V1.2

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TABLE OF CONTENTS

HEMP CARBON STANDARD: BIOHAR PRODUCTION METHODOLOGY

1. INTRODUCTION

This methodology quantifies the net CO2 removal achieved through the production of biochar from industrial hemp biomass, when used in sustainable environmental applications. By transforming carbon captured in biomass through photosynthesis into a stabilized form in biochar, we significantly delay its return to the atmosphere, achieving a higher resistance to degradation processes compared to the original biomass.

1.1 Scope and Applicability

This methodology is applicable to projects involving the cultivation of industrial hemp specifically for biochar production and its subsequent carbon sequestration benefits. It is designed to be flexible across various geographical and regulatory environments, ensuring compliance with both local and international environmental standards. The methodology is intended for use by project developers, carbon credit issuers, environmental agencies, and regulatory bodies to ensure that all phases of the process—from hemp cultivation to biochar application and carbon credit issuance—are conducted under stringent quality control measures and contribute effectively to carbon sequestration.

Project Types:

- **Hemp Cultivation**: Projects focusing on the sustainable cultivation of industrial hemp for biomass that will be converted into biochar.
- **Soil Remediation**: Projects utilizing hemp biochar for soil health improvement, including enhancing fertility, structure, and pollutant remediation.
- **Carbon Sequestration**: Projects aimed at sequestering carbon through the stable carbon matrix of biochar, including its use in agricultural lands, contaminated site remediation, and urban greening applications.

Geographical Applicability:

- **Climate Zones**: Suitable for a wide range of climates where hemp can be sustainably cultivated, from temperate to subtropical regions.
- **Soil Types**: Applicable to various soil types, ensuring that biochar application is tailored to enhance soil properties without adverse effects, suitable even for degraded and contaminated soils.

Regulatory Compliance:

- **Local and International Standards**: Compliance with environmental regulations is mandatory, including adherence to standards such as ISO 14064 for greenhouse gas accounting and ISO 14040/44 for life cycle assessment. Projects must also comply with local agricultural and environmental regulations concerning hemp cultivation and biochar production.

This methodology aims to provide a comprehensive framework that supports the scalable implementation of hemp biochar projects. By ensuring that these projects are conducted in an environmentally responsible and scientifically sound manner, the methodology facilitates significant contributions to carbon sequestration efforts globally, promoting sustainable agricultural practices and improving soil health through innovative uses of hemp biomass.

1.2 Eligible Activity Type:

Eligible activities under this methodology must produce biochar with exceptional long-term stability. CO2 removal is achieved primarily through the thermal processes of pyrolysis or gasification in an oxygen-limited environment, where the biomass undergoes a carbonization reaction to form solid biochar. This biochar is characterized by carbon bonds stronger than those in the parent biomass, rendering it more resistant to both biotic and abiotic degradation.

1.3 Focused Applications:

- **Burial Techniques**: Biochar can be applied using specific burial techniques where it is incorporated into subterranean layers to lock away carbon for extended periods, enhancing soil quality and structure as a secondary benefit.
- **Orphaned Oil Well Remediation**: Utilizing biochar to cap abandoned or orphaned oil wells provides a secure method of carbon storage, potentially aiding in the remediation of soil and groundwater contamination.
- **Soil Amendment**: As a soil amendment, biochar improves soil fertility and water retention, supports microbial life, and enhances plant growth, thereby contributing to more sustainable agricultural practices.
- **Biochar-Enhanced Concrete or Hempcrete:** Incorporating biochar into hempcrete or other bio-based concrete products to increase the material's carbon sequestration capacity, thermal insulation properties, and durability Biochar can be mixed with hemp shiv and lime binder to create a lightweight, sustainable building material known as biochar-enhanced hempcrete. This application not only utilizes the carbon sequestration benefits of both hemp and biochar but also contributes to the construction of greener buildings.

Biochar stability and suitability for these applications are determined by a molar hydrogen to organic carbon (H/C_{org}) ratio lower than 0.2, indicating minimal environmental degradability.

By adhering to these criteria, projects can generate CRUs that represent verifiable, quantifiable, and permanent CO2 removal, promoting the use of industrial hemp in addressing environmental challenges and advancing sustainability goals.

1.4 Need to Create a Project Design Document (PDD) and Its Contents

A Project Design Document (PDD) is crucial for detailing the project's approach, methodologies, expected outcomes, and management strategies in the context of hemp biochar production and application. This document plays a vital role in ensuring the project's transparency, accountability, and effectiveness in carbon sequestration and environmental management.

Contents of the PDD should include:

- **Detailed Project Description**: This section should outline the scope of the biochar project, including the geographical areas involved, the scale of hemp cultivation, biochar production processes, and intended applications of the biochar It should detail the project's alignment with sustainable agricultural practices and the overarching goals of carbon sequestration and soil enhancement.

- **Biochar Production and Application Methodologies**: Describe the technical processes for converting hemp biomass into biochar, including the type of pyrolysis or gasification used, operational parameters, and the handling and storage of biochar. The methodologies for applying biochar in various environmental settings such as agriculture, land remediation, or waterfiltration should also be detailed.

- **Measurement, Reporting, and Verification (MRV) Strategies**: This section must specify the methods for measuring the biochar's carbon content and its sequestration potential, along with the protocols for ongoing monitoring and reporting. This includes detailing the tools and technologies used for data collection and analysis.

- **Environmental and Socio-economic Impacts**: Assess and document the potential environmental impacts of the project, including benefits such as soil health improvement and pollutant removal. The socio-economic impacts, particularly on local communities and economies, should also be evaluated, highlighting any job creation, community involvement, or educational opportunities.

- **Monitoring Plan and Data Management**: Outline a comprehensive monitoring plan that includes schedules, locations, and techniques for data collection. The plan should detail how data will be managed, stored, and analyzed to ensure integrity and accessibility.

- **Risk Assessment and Management Plan**: Provide an analysis of potential risks associated with the project, including environmental risks, market risks, and operational risks. This section should also propose mitigation strategies to address identified risks and ensure the project's sustainability and safety

- **Stakeholder Engagement and Communication Plan**: Detail the strategies for engaging with stakeholders, including local communities, government agencies, and other relevant parties. This plan should describe how stakeholders will be informed and involved in the project, including through public consultations and participatory approaches.

The PDD serves as a foundational document that not only guides the project implementation but also facilitates the validation and certfication processes under relevant standards. By providing a clear and comprehensive description of all aspects of the project, the PDD helps ensure that the project achieves its intended goals while adhering to the highest standards of environmental and social governance.

1.5 Additionality

Definition:

In the context of the HCS Industrial Hemp Biochar Methodology additionality refers to the greenhouse gas reductions and carbon sequestration that occur as a direct result of biochar production and application, which would not have occurred under a business-as-usual scenario.

Demonstrating Additionality:

Additionality for industrial hemp biochar is substantiated by addressing economic, regulatory, and technical barriers that would prevent the adoption of biochar production and usage without the incentive of carbon credits.

Economic and Market Barriers:

- **Emerging Market Presence**: Like many novel environmental technologies, the market for biochar, particularly from hemp, is nascent. The lack of established supply chains and fluctuating demand makes it challenging for businesses to commit to large-scale production without external incentives.
- **Cost Competitiveness**: Despite its environmental benefits, the initial costs associated with setting up biochar production facilities, including equipment and

operational expenses, are typically higher than those for more traditional carbonization processes.

Regulatory and Legal Hurdles:

- **Regulatory Complexity**: Navigating the legal landscape for hemp cultivation and biochar production involves overcoming numerous hurdles, including stringent regulations and varying legal status across jurisdictions.
- **Certification and Standards**: There are limited standardized guidelines specfic to hemp biochar, which complicates the certification processes necessary for market acceptance and consumer trust.

Technical and Production Challenges:

- **Production Infrastructure**: The lack of specialized infrastructure for large-scale biochar production from hemp limits the ability to fully realize the potential of this material. Developing such infrastructure requires signficant investment and innovation.
- **Research and Development Needs**: There is a continuous need for scientific and technical research to optimize biochar yield and quality which involves overcoming technological barriers and proving the efficacy and safety of hemp biochar applications.

Mitigation Through Carbon Credits:

- **Enable Scalability**: Carbon credits provide essential financial support that offsets the significant upfront costs associated with pioneering biochar projects, making it economically viable for producers to scale operations.
- **Market Stimulation**: By providing financial incentives, carbon credits help stimulate demand for hemp biochar, supporting the development of a robust market. This, in turn, encourages further investments and fosters industry growth.
- **Support for Compliance and Innovation**: Financial incentives from carbon credits can facilitate compliance with regulatory requirements and foster innovation in biochar production technologies and applications.

This framework ensures that the additional carbon sequestration achieved through hemp biochar projects is real, measurable, and beyond what would occur in the absence of such projects, directly contributing to global climate mitigation efforts. By addressing these barriers, the methodology not only enhances the viability of biochar projects but also ensures their sustainability and environmental integrity

1.6 Leakage

Definition:

In the context of the HCS Industrial Hemp Biochar Methodology leakage refers to any increase in greenhouse gas emissions outside the project boundary that occurs as a direct or indirect result of the project's activities. This concept is crucial as it can significantly undermine the net carbon sequestration benefits that the project aims to achieve.

Types of Leakage:

- **Activity Shifting Leakage**: This type of leakage occurs when activities that produce emissions are relocated from the project area to another location. For hemp biochar, this could happen if land previously used for other agricultural purposes is converted to hemp cultivation, potentially displacing agricultural activities to areas with less sustainable practices, leading to increased emissions.

- **Market Leakage**: Market leakage arises when the project's influence on supply and demand dynamics leads to increased emissions outside the project area. In the case of biochar, this could occur if the increased demand for hemp biochar leads to intensified cultivation or production activities in regions not adhering to sustainable practices, thereby increasing overall emissions.

Mitigation Strategies:

- **Comprehensive Monitoring**: Implementing robust monitoring systems to track and measure emissions within and adjacent to the project area is essential. This helps identify where leakage might be occurring and the factors contributing to it.

- **Incentive Mechanisms**: Providing incentives for all stakeholders, including farmers, producers, and end-users, to adopt and maintain sustainable practices can help mitigate leakage. These incentives could be financial, such as subsidies or tax breaks, or non-financial, such as recognition programs.

- **Leakage Buffer**: Establishing a buffer pool of carbon credits is a practical approach to account for any unavoidable leakage. This buffer acts as an insurance mechanism, ensuring the integrity of the carbon savings claimed by the project despite potential unforeseen emissions.

- **Sustainable Sourcing Policies**: Developing and enforcing policies that require sustainable sourcing of all raw materials, including hemp, can reduce the risk of activity-shifting leakage. This involves ensuring that hemp is cultivated and harvested in a manner that does not lead to environmental degradation elsewhere.

- **Engagement and Collaboration**: Working collaboratively with local communities, governments, and other stakeholders to support sustainable development goals can help mitigate both types of leakage. By promoting sustainable practices beyond the project boundaries, the overall environmental impact of the industry can be reduced.

Implementing these strategies requires careful planning and continuous evaluation to ensure they effectively address potential leakage and contribute to the overall success and sustainability of the hemp biochar project.

1.7 Boundaries

Definition:

In the context of the HCS Industrial Hemp Biochar Methodology project boundaries are essential for defining the spatial and temporal limits within which the carbon sequestration and other environmental impacts of biochar production and application are assessed and monitored. Establishing clear boundaries is crucial for ensuring the accuracy and integrity of the project's environmental claims.

Components:

Geographical Boundaries:

- These boundaries specify the physical areas involved in the project, including where the hemp is cultivated, where the biochar is produced, and where it is ultimately applied. Clear delineation of these areas prevents overlap with other projects and ensures precise measurement of impacts.

Temporal Boundaries:

- Temporal boundaries define the time frame over which the project's activities are considered for carbon accounting and environmental monitoring. This includes the period of hemp growth, the biochar production process, and the duration of biochar's environmental impact, including its application and potential end-of-life scenarios.

Operational Boundaries:

- Operational boundaries encompass all sources of greenhouse gas emissions and carbon sinks within the project area. This includes emissions from hemp cultivation, transportation of raw materials and finished biochar, biochar production processes, and the sequestration potential of biochar in its application settings.

Mitigation Strategies:

Detailed Project Design Document (PDD):

- The PDD should include comprehensive maps and geographic information system (GIS) data to clearly define and document the geographical boundaries of the project. This documentation supports the precise planning and implementation of project activities and aids in accurate reporting.

Comprehensive MRV (Monitoring, Reporting, and Verification) Plan:

- Develop and implement an MRV plan that establishes protocols for continuous monitoring of the defined boundaries. This plan should detail how emissions and sequestration will be measured, reported, and verified over time to ensure they align with the project's environmental goals and compliance requirements.

Stakeholder Engagement:

- Engage local communities and other stakeholders in defining and maintaining the project boundaries. Their involvement is critical for ensuring the project's acceptance and enhances compliance with local regulations. Additionally integrating community insights and priorities into the project planning and monitoring processes promotes transparency and trust.

Establishing and maintaining well-defined project boundaries is vital for the credibility and success of the biochar project under the HCS methodology. It ensures that all environmental impacts are accurately captured and managed, supporting the integrity and verifiability of carbon sequestration claims. This approach not only facilitates regulatory compliance but also enhances the project's sustainability and effectiveness in contributing to broader environmental goals.

1.8 Do No Harm & Environmental Issues

Principle:

The "Do No Harm" principle is central to the HCS Industrial Hemp Biochar Methodology ensuring that the production and application of biochar do not adversely affect local communities, ecosystems, or biodiversity. This principle mandates that all project activities not only avoid harm but also aim to positively impact the environmental and social landscapes in which they operate.

Key Considerations:

Biodiversity Protection:

- **Habitat Conservation**: Ensure that the cultivation of hemp for biochar does not replace or negatively impact natural habitats such as forests, grasslands, or wetlands. Practices should include maintaining buffer zones around sensitive ecosystems and adopting biodiversity conservation measures in farming practices.
- **Environmental Impact Assessments (EIA)**: Conduct comprehensive EIAs to evaluate potential impacts of hemp cultivation and biochar production on local flora and fauna. These assessments help identify, predict, and mitigate any adverse effects before they occur.

Water Use and Soil Health:

- **Sustainable Water Management**: Implement water management practices that prevent the depletion of local water resources. Although hemp typically requires less water than traditional crops, the methodology encourages the use of sustainable irrigation techniques and water conservation measures.
- **Soil Preservation**: Promote soil health practices that prevent degradation and erosion, such as minimal tillage, crop rotation, and the use of organic amendments. Regular monitoring of soil health is crucial to ensure that biochar application improves soil structure and fertility without leading to adverse effects like salinization.

Invasive Species Management:

- **Control Measures**: Implement management plans to monitor and control the spread of hemp to ensure it does not become invasive. This includes periodic reviews of cultivation practices and readiness to adapt to ecological changes or unforeseen consequences.

Chemical Use:

- **Minimization of Agrochemicals**: Encourage the use of organic farming practices to minimize the use of synthetic pesticides and fertilizers. While hemp has natural pest resistance, any necessary chemical treatments should prioritize environmentally friendly options.
- **Safe Chemical Handling**: Provide regular training for farmers and biochar producers on the safe and effective use of chemicals, ensuring they do not harm the surrounding environment or human health.

Mitigation Strategies:

- **Ecosystem Services Enhancement**: Beyond avoidance of harm, projects should aim to enhance ecosystem services through activities such as creating wildlife corridors within hemp plantations or using biochar to rehabilitate degraded lands.
- **Community Engagement and Capacity Building**: Engage local communities in project planning and implementation to align project activities with local needs and environmental goals. This includes education and training programs that raise awareness about the benefits of biochar and sustainable practices.
- **Monitoring and Adaptive Management**: Establish ongoing monitoring systems to track the environmental and social impacts of biochar projects. Use adaptive management strategies to respond to monitoring results and ensure continuous improvement in environmental performance.

By adhering to the "Do No Harm" principle, the biochar methodology not only safeguards against negative impacts but also actively contributes to environmental sustainability and community well-being. This approach fosters a positive legacy for the use of industrial hemp in biochar production, ensuring that these practices are beneficial on multiple levels and sustainable over the long term.

1.9 Reversals

Definition:

In the context of the HCS Industrial Hemp Biochar Methodology reversals refer to any event or series of events that result in the previously sequestered carbon being released back into the atmosphere. This could occur due to natural disasters,fires, material decomposition, or mismanagement in the handling and application of biochar

Mitigation Strategies:

Buffer Reserves:

- **Establishment of Buffer Reserves**: Create a reserve pool of carbon credits to compensate for any unforeseen carbon losses. This buffer acts as an insurance mechanism to maintain the integrity of the carbon credits, even if some sequestration is reversed.
- **Size and Management of the Buffer**: The size of the buffer should be determined based on historical data, risk assessments, and the specific geographic and operational contexts of the biochar projects. It should be dynamically managed, with adjustments made based on actual performance and monitoring data.

Risk Management Plans:

- **Development of Comprehensive Plans**: Develop plans that outline preventive measures and contingency actions to address potential causes of reversals. For biochar, this might include strategies to manage the stability of biochar during storage, transportation, and application.
- **Integration with Local Management Practices**: Align risk management strategies with local environmental management and disaster preparedness plans to enhance their effectiveness and responsiveness.

Continuous Monitoring:

- **Implementation of Monitoring Systems**: Implement continuous monitoring mechanisms to track the status and integrity of the sequestered carbon in biochar This could include the use of IoT sensors at storage or application sites to detect conditions that might lead to carbon release.
- **Verification and Reporting**: Regularly verify the status of stored carbon through third-party audits and detailed reporting. This transparency helps to maintain trust in the carbon sequestration claims and the overall credibility of the methodology

Advanced Technologies:

- **Use of Technology in Monitoring**: Apply advanced technologies such as remote sensing, satellite imagery, and other real-time data collection tools to monitor conditions at biochar production sites and application areas. These technologies can provide early warnings of adverse conditions that might lead to reversals.

By implementing these strategies, the biochar methodology not only protects against the potential loss of sequestered carbon but also reinforces the reliability of the carbon sequestration claims associated with hemp biochar. These measures ensure that the environmental benefits promised by the biochar application are durable and verifiable over the long term, contributing significantly to global climate mitigation efforts.

1.10 Co-Benefits

Definition:

Co-benefits refer to the additional positive outcomes that result from projects involving hemp biochar, extending beyond the primary goal of carbon sequestration. These benefits enhance the overall sustainability and impact of the projects on local communities and the environment.

Examples of Co-Benefits:

Economic Benefits:

- **Local Economic Growth**: The production and application of hemp biochar can stimulate local economies by creating jobs in hemp cultivation, biochar production, and various environmental applications. The emerging market for biochar offers new economic opportunities for farmers, producers, and environmental service providers.
- **Innovation and Investment**: Projects focused on hemp biochar can attract investment into research and development, fostering innovation in sustainable environmental practices and biochar applications such as soil remediation and water filtration.

Ecological Benefits:

- **Soil Health Improvement**: Biochar is known for its ability to improve soil fertility, increase water retention, and reduce the need for chemical fertilizers. By enhancing soil structure and nutrient availability, biochar supports more sustainable agricultural practices.

- **Biodiversity Enhancement**: The incorporation of biochar into agricultural lands can improve habitat quality and support a diverse range of biological species, contributing to the restoration and maintenance of local biodiversity

Social Benefits:

- **Community Engagement and Capacity Building**: Biochar projects can engage local communities through participatory approaches, increasing awareness about sustainability and providing training in the production and use of biochar. This fosters community involvement and empowerment.
- **Improvement of Air and Water Quality**: Hemp biochar can capture pollutants from both air and water, contributing to environmental cleanup and public health improvements. This is particularly beneficial in areas affected by industrial pollution.

Implementation Strategies:

- **Stakeholder Engagement**: Involve local communities, governments, and other stakeholders in the planning and implementation of biochar projects to ensure that they address local needs and gain widespread support. This inclusion helps tailor the projects to provide the most relevant economic, ecological, and social benefits.
- **Educational Programs**: Conduct educational programs to inform community members about the environmental benefits of biochar and its applications. Training can focus on techniques for producing and applying biochar effectively, thus spreading knowledge and skills that boost local environmental and agricultural initiatives.
- **Transparency and Reporting**: Maintain high levels of transparency in reporting all project outcomes, including both the quantified carbon sequestration and the broader co-benefits. Regular, transparent reporting builds trust and demonstrates the project's value, supporting continued community and stakeholder support.

By embracing these co-benefits, biochar projects not only contribute to carbon sequestration goals but also foster broader environmental sustainability, economic development, and social well-being. This holistic approach ensures that hemp biochar projects deliver value that extends well beyond their initial environmental impact, making them a key component of sustainable development strategies.

1.11 Substitutions

Valid Substitutions

Hemp biochar utilized within this methodology must serve as an effective and valid substitute for conventional soil amendments or remediation agents outlined in the baseline scenario. This includes traditional materials such as chemical fertilizers, non-renewable soil enhancers, and other carbon-based materials used for environmental remediation.

Criteria for Substitution

Project developers must demonstrate how hemp biochar substitutes the baseline materials based on the following characteristics:

- **Function of the Product**: Hemp biochar must fulfill the same or superior functional requirements as the conventional materials it replaces, such as soil fertility enhancement, water retention, and pollutant removal capabilities.
- **Service Lifetime**: The effective duration of hemp biochar's benefits should match or exceed that of the baseline materials, ensuring durability and long-term utility
- **Performance**: Performance indicators specific to biochar, such as its ability to improve soil health, store carbon, and enhance microbial activity must be assessed.
- **Price/Quality Ratio**: While biochar may initially be more costly due to production complexities, its overall quality and lifecycle benefits, such as reduced need for synthetic inputs and improved crop yields, should be highlighted.

Performance Indicators

These may include:

- **Soil Health Improvement**: The capacity of hemp biochar to enhance soil structure, fertility, and water retention compared to traditional soil amendments.
- **Pollutant Removal**: The effectiveness of biochar in adsorbing and immobilizing contaminants compared to other remediation materials.
- **Carbon Sequestration**: The ability of biochar to store carbon within its matrix over long periods compared to less stable organic materials.

Sources for verifying these performance indicators include product-specfic performance tests, scientific literature, and Environmental Product Declarations (EPDs).

Source Documentation

Developers should reference credible sources such as standardized performance tests and certified EPDs to validate the claimed performance and functionality of hemp biochar

Performance Comparison in Project Scenarios

If the performance of hemp biochar differs from that of the baseline materials, developers must:

- **Quantify Differences**: Clearly account for any performance differences, particularly if biochar outperforms traditional materials, providing a better environmental or economic return.
- **Risk Evaluation**: Consider any potential negative impacts, such as changes in soil pH or nutrient availability, and manage these through informed application strategies.

Service Lifetime Comparison

If there is a significant difference in the service lifetimes of hemp biochar compared to the baseline materials, this difference should be factored into the comparative Life Cycle Assessment (LCA). This ensures that the environmental impacts and benefits are accurately represented over the functional life of the materials.

This section establishes clear guidelines for evaluating the substitution potential of hemp biochar, ensuring it is not only sustainable but also functionally competitive when compared to conventional materials. This approach helps to maintain the integrity of the environmental benefits claimed by the project and supports broader acceptance and integration of hemp biochar into mainstream environmental management practices.

1.12 Permanence

Permanence of Carbon Storage

Permanence in the context of the HCS Industrial Hemp Biochar Methodology refers to the duration over which carbon sequestered by biochar is securely stored, preventing its re-release into the atmosphere. For hemp biochar to qualify for carbon sequestration credits under this methodology, it must demonstrate an expected carbon storage duration of 100 years or more.

Carbon Storage Duration Determination

- **Total Carbon Storage Duration**:
  - The total carbon storage duration for biochar includes the period during which the carbon remains locked within the biochar from its initial application through any potential future use phases such as soil amendment or as a filtration medium. This duration extends beyond biochar's primary service life to include additional years if the biochar is repurposed or remains stable in landfilled environments.

- **Reference Service Lifetime**:
  - By default, the carbon storage duration is assumed to equal the reference service lifetime provided in the biochar's Environmental Product Declaration (EPD). This duration is based on normative data reflecting average conditions of biochar application, environmental exposure, and interaction.

- **Extended Carbon Storage Justification**:
  - Project developers may argue for a longer carbon storage duration than the standard service lifetime if substantial evidence supports such claims. Justifications must rely on credible sources such as scientific research, industry reports, public databases, or performance tests that demonstrate biochar's durability and stability under various conditions.

- **Composite Material Considerations**:
  - If biochar is used in composite applications, such as in construction materials or mixed with other organic or inorganic substances, the carbon storage duration of the final product is considered, based on the component with the shortest expected lifespan, unless treatment or protective measures ensure longer security of carbon storage.

Risk of Reversal

- **Risk Evaluation**:
  - A detailed risk evaluation for potential carbon storage reversal is mandatory This evaluation must assess social, economic, natural, and operational risks that might compromise the permanence of carbon storage.

- **Risk Scoring**:
    - Developers are required to assign a likelihood and severity score to each identfied risk, providing detailed explanations for their assessments. The HCS Certfication team reviews these evaluations and may suggest adjustments to risk scores based on their analysis.
- **Additional Risk Considerations**:
    - Depending on the project's specific context, the HCS Certification team or the project developer might identify and evaluate additional risks not initially considered.
- **Risk Mitigation Requirements**:
    - For each risk identified as high or very high, a detailed risk mitigation plan must be developed. This plan should outline strategies and investments aimed at preventing, monitoring, reporting, and compensating for potential carbon reversal. Alternatively, or additionally, contributions to a buffer pool may be required, calculated at a rate of 3% of the verified removal HCS Carbon Credits for each high-risk factor.

This section ensures that all parties involved in the production and application of hemp biochar have a clear understanding of the requirements and responsibilities regarding the permanence and integrity of carbon sequestration claims. Such rigorous assessment and planning are crucial for maintaining the credibility and effectiveness of the environmental benefits associated with hemp biochar.

1.13 Definitions and Key Terms

Biochar: A carbon-rich product derived from the thermal decomposition of organic material (biomass) under limited oxygen supply (pyrolysis), used for various purposes including carbon sequestration, soil amendment, and filtration.

Carbon Sequestration: The process by which atmospheric carbon dioxide is captured and stored to mitigate or defer climate change. Biochar contributes to this by stabilizing carbon in a solid form that is resistant to decomposition.

Hemp Biomass: The organic plant material derived from the hemp plant, used as the feedstock for biochar production. It includes all parts of the plant, such as stalks, leaves, and seeds, typically left after extracting high-value compounds.

Pyrolysis: A thermal decomposition process used to convert organic materials into biochar, synthetic gas, and oil under high temperatures in the absence of oxygen.

Gasification: A process that converts organic or fossil-based carbonaceous materials into carbon monoxide, hydrogen, and carbon dioxide. This is achieved by reacting the material at high temperatures, without combustion, with a controlled amount of oxygen and/or steam.

Life Cycle Assessment (LCA): A technique to assess environmental impacts associated with all the stages of a product's life from-cradle-to-grave (from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling).

Carbon Removal Unit (CRU): A unit representing the removal of one metric ton of carbon dioxide from the atmosphere, verified through standardized protocols, specifically relating to biochar's carbon sequestration capabilities.

Stability Ratio (H/Corg): A metric used to determine the stability of biochar. A lower ratio indicates a higher stability and lesser likelihood of degradation, thus enhancing its sequestration potential.

Sustainable Biomass Source: Refers to biomass derived from practices that do not lead to the degradation of the environment and help in maintaining the ecological balance.

Verification and Certification: Processes that ensure biochar production and application meet predefined standards for carbon sequestration and environmental sustainability

Environmental Product Declaration (EPD): A standardized document providing detailed information about a product's environmental impact throughout its lifecycle, often used in evaluating the environmental performance of biochar.

Thermal Stability: The ability of biochar to resist changes in its chemical structure and thus maintain its carbon content under typical environmental conditions over extended periods.

Feedstock: The raw material used for producing biochar, in this case, hemp biomass, which influences the properties and sequestration potential of the resulting biochar

Orphaned Oil Well Remediation: The use of biochar to cap abandoned or orphaned oil wells as a method of carbon storage, potentially aiding in the remediation of soil and groundwater contamination.

Soil Amendment: The addition of biochar to soil to improve its quality for agricultural purposes, which involves enhancing nutrient retention, moisture stability, and microbial activity.

These terms define the scope and application of biochar within the context of this methodology, outlining the parameters for production, application, and the expected outcomes in terms of environmental and carbon sequestration performance.

2. REQUIREMENTS FOR ACTIVITES TO BE ELIGIBLE UNDER THE HEMP CARBON STANDARD METHODOLOGY

2.1 Biochar Applications Ensuring Carbon Storage:

- Biochar derived from industrial hemp must be used in applications that ensure long-term carbon storage without releasing carbon back into the atmosphere. Suitable applications include:
  - **Burial techniques**: Subsurface burial methods where biochar is incorporated at depths that prevent oxidation and enhance soil carbon content.
  - **Orphaned oil** well remediation: Utilization of biochar in orphaned or abandoned oil well sites to cap wells, thereby sequestering carbon and potentially reversing soil and groundwater contamination.
  - **Soil Amendment**: Application of biochar to agricultural or garden soils to improve soil health, enhance nutrient availability, increase water retention, and reduce chemical runoff, thereby enhancing crop yields and supporting sustainable farming practices.
  - **Biochar-Enhanced Concrete or Hempcrete:** Use of biochar in the production of hempcrete or other concrete forms, where biochar acts as an additive to improve the material's carbon sequestration capabilities, thermalnsulation properties,

and overall sustainability. This application is particularly beneficial in the construction industry, promoting the use of greener building materials that lock in carbon for the lifetime of the structure.

- Prohibited uses include any applications where biochar is combusted or used as a reductant, thereby releasing stored carbon.

2.2 Sustainable Biomass Source:

- Biochar must be produced exclusively from industrial hemp biomass, cultivated sustainably to ensure no adverse impact on soil health and biodiversity. Hemp used must comply with regulatory standards for sustainable agriculture, verifying minimal use of chemical inputs and adherence to crop rotation practices.

2.3 Life Cycle Assessment (LCA) for Net Negativity:

- Producers must demonstrate net-negative carbon emissions through comprehensive LCAs that include the cultivation, processing, and end-use of hemp biochar. The assessment should follow ISO 14040/44 guidelines, providing detailed emission data at each stage.

2.4 Emission Controls in Production:

- During biochar production, any use of fossil fuels for reactor pre-heating or ignition must be strictly controlled. Co-firing of biomass and fossil fuels is not permitted to prevent contamination of biochar with fossil carbon.
- All pyrolysis gases must be either combusted to energy or captured for use, ensuring minimal methane emissions.

2.5 Biochar Stability and Quality Requirements:

- The biochar must exhibit a molar H/C_org ratio of less than 0.6, ensuring its stability and resistance to degradation.
- Compliance with existing quality standards for biochar use, such as those concerning heavy metals and PAHs, must be demonstrated. Standards from the International Biochar Initiative or the European Biochar Certificate may guide these criteria.

2.6 Safety and Environmental Compliance:

- Producers must implement rigorous safety protocols to handle and transport biochar, ensuring operations are free from health hazards.

- A Material Safety Data Sheet must be provided for each batch of biochar, and appropriate measures for flue gas treatment and biochar cooling post-production are mandatory.

2.7 Production Facility Audit and CRU Certification:

- The production facility must undergo regular audits to verify that it meets the Hemp Carbon Standard requirements.
- CRUs (Carbon Removal Units) are issued based on verified and documented biochar production, ensuring that each unit represents genuine, quantifiable, and permanent carbon removal.

These requirements are designed to align with the specific goals of the Hemp Carbon Standard, promoting sustainable and verifiable carbon sequestration practices within the biochar industry from industrial hemp.

3. POINT OF CREATION OF THE CO2 REMOVAL CERTIFICATES (CRUs)

3.1. Point of Creation

3.1.1. The point of creation of the CRU is identified at the completion of the biochar production process, specifically during pyrolysis or gasification of industrial hemp biomass. To qualify, the biochar must be designated for uses that ensure long-term carbon storage, excluding any energy generation purposes.

3.1.2. Eligible applications of the biochar that qualify for CRU issuance include:

- **Burial Techniques**: Biochar is integrated into subsurface layers or used in other burial methods where it remains stable and does not contribute to atmospheric CO2 levels.
- **Orphaned Oil Well Remediation**: Biochar is used to fill abandoned oil wells, aiding in carbon sequestration and potentially aiding in the remediation of surrounding contaminated environments.
- **Soil Amendment**: Biochar is applied to soil to improve fertility and structure while sequestering carbon.
- **Biochar-Enhanced Concrete or Hempcrete**: Biochar is incorporated into building materials like hempcrete, contributing to the carbon sequestration properties of these materials.

3.2. Verification and Certification

3.2.1. Following biochar production, the end-use application must be verfied to ensure compliance with the stipulated carbon sequestration methods. Only upon verification that the biochar is used appropriately, CRUs are issued.

3.2.2. The biochar producer, recognized as the CO2 Removal Supplier, is responsible for documenting and proving the eligible use of biochar to the certifying body

4. COMPREHENSIVE LIFE CYCLE ASSESSMENT (LCA)

The enhanced LCA section provides a detailed and systematic approach to quantify greenhouse gas (GHG) emissions across all stages of the biochar production and application process. This section ensures comprehensive accounting of emissions and includes improved methodologies, formulas, diagrams, and tables.

Scope and Boundary:

- **Cradle-to-Grave Assessment**: The LCA covers all stages from biomass production to the final application of biochar. This comprehensive approach ensures that all emissions and carbon sequestration opportunities are accounted for, providing a complete picture of the biochar's environmental impact.

Stages Covered:

- **Biomass Production**: Emissions from the cultivation, harvesting, and transportation of industrial hemp.
- **Biochar Production**: Emissions from biomass handling, drying, pyrolysis, and post-processing.
- **Biochar Use**: Emissions from transportation, application, and long-term carbon storage in various applications.

LCA Framework:

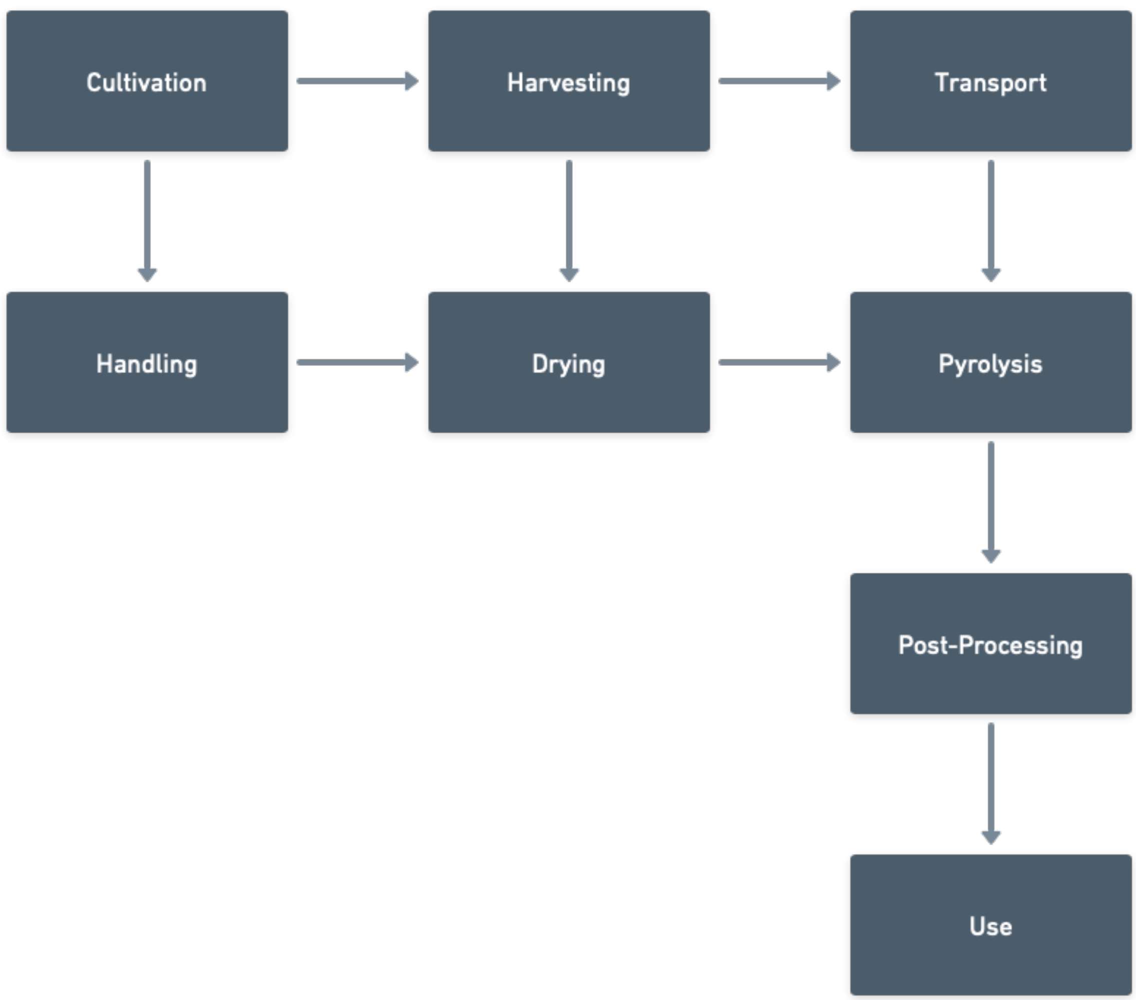
The LCA framework includes the following steps:

1. **Goal and Scope Definition**: Clearly define the objectives, system boundaries, and functional unit of the LCA.
2. **Inventory Analysis**: Collect data on all inputs and outputs, including energy use, raw materials, and emissions.

3. **Impact Assessment**: Evaluate the potential environmental impacts of the inventory data.
4. **Interpretation**: Analyze the results to identify significant impacts and areas for improvement.

4.1 System Boundary and Process Flow Diagram:

The system boundary includes all activities from hemp cultivation to the end-use of biochar. The process flow diagram (Figure 1) illustrates the key stages and interactions within the system boundary.



Detailed Description of Stages

- **Cultivation**:
  - **Description**: Growing industrial hemp.
  - **Inputs**: Seeds, water, fertilizers.
  - **Outputs**: Hemp biomass.

- **Harvesting**:
  - **Description**: Collecting hemp biomass.
  - **Inputs**: Labor, machinery.
  - **Outputs**: Harvested hemp.

- **Transport**:
  - **Description**: Moving harvested hemp to processing facilities.
  - **Inputs**: Fuel, transportation vehicles.
  - **Outputs**: Delivered hemp biomass.

- **Handling**:
  - **Description**: Preparing biomass for drying.
  - **Inputs**: Labor, handling equipment.
  - **Outputs**: Prepared biomass.

- **Drying**:
  - **Description**: Reducing moisture content of biomass.
  - **Inputs**: Energy (electricity, heat).
  - **Outputs**: Dried biomass.

- **Pyrolysis**:
  - **Description**: Converting biomass to biochar through thermal decomposition.
  - **Inputs**: Heat, controlled oxygen environment.
  - **Outputs**: Biochar, syngas, bio-oil.

- **Post-Processing**:
  - **Description**: Refining biochar for specific applications.
  - **Inputs**: Energy, processing equipment.
  - **Outputs**: Processed biochar.
- **Use**:
  - **Description**: Applying biochar in end-use applications (e.g., soil amendment, construction material).
  - **Inputs**: Transportation, application tools.
  - **Outputs**: Carbon sequestered biochar in final use.

4.2 Baseline Emissions:

Baseline emissions for biochar feedstock are considered zero unless scientfically justified otherwise. The default baseline scenario assumes no biochar production or application, providing a conservative comparison for net carbon sequestration.

4.3 Calculation Methodology:

The net CO2 removal is calculated using the following formula:

$$CRUs = E_{\text{stored}} - (E_{\text{biomass}} + E_{\text{production}} + E_{\text{use}})$$

Where:

- E_{stored} = Carbon stored in biochar
- E_{biomass} = Emissions from biomass production
- $E_{\text{production}}$ = Emissions from biochar production
- E_{use} = Emissions from biochar use

4.4 Biochar Carbon Storage (E_{stored})

The carbon storage potential of biochar is calculated as follows:

$$E_{\text{stored}} = Q_{\text{biochar}} \times C_{\text{org}} \times F_{\text{TH,TS}} \times \frac{12}{44}$$

Where:

- Q_{biochar} = Dry metric tonnes of biochar produced
- C_{org} = Organic carbon content of the biochar
- $F_{\text{TH,TS}}$ = Permanence factor based on time horizon (TH) and soil temperature (TS)
- $\frac{12}{44}$ = Conversion factor from carbon to CO2 equivalent

Table 1: Permanence Factors ($F_{\text{TH,TS}}$) for Various Soil Temperatures

Soil Temperature ($^{\text{o}}$C)	C	M	$F_{\text{TH,TS}}$
5	1.13	-0.46	0.67
10	1.10	-0.59	0.51
15	1.04	-0.64	0.40
20	1.01	-0.65	0.36
25	0.98	-0.66	0.32

4.5 Biomass Production and Supply (E_{biomass})

Emissions from biomass production and supply are calculated as follows:

$$E_{\text{biomass}} = \sum_{i=1}^{n} (E_{\text{cultivation}} + E_{\text{harvesting}} + E_{\text{transport}})$$

Where:

- $E_{\text{cultivation}}$ = Emissions from cultivation practices (e.g., fertilizers, irrigation)
- $E_{\text{harvesting}}$ = Emissions from harvesting operations
- $E_{\text{transport}}$ = Emissions from transporting biomass to the production facility

4.6 Biochar Production ($E_{\text{production}}$)

Emissions from biochar production are calculated as follows:

$$E_{\text{production}} = E_{\text{handling}} + E_{\text{drying}} + E_{\text{pyrolysis}} + E_{\text{post-processing}}$$

Where:

- E_{handling} = Emissions from biomass handling
- E_{drying} = Emissions from drying the biomass
- $E_{\text{pyrolysis}}$ = Emissions from the pyrolysis process
- $E_{\text{post-processing}}$ = Emissions from post-production processing

4.7 Biochar Use (E_{use})

Emissions from biochar use are calculated as follows:

$$E_{\text{use}} = E_{\text{transport}} + E_{\text{application}}$$

Where:

- $E_{\text{transport}}$ = Emissions from transporting biochar to application sites

- $E_{\text{application}}$ = Emissions from applying biochar in its final use

Table 2: Example LCA Data for Biochar Production and Use

Stage	Emission Source	Emissions (kg CO2e)
Biomass Production	Cultivation, harvesting, transport	1000
Biochar Production	Handling, drying, pyrolysis	1500
Biochar Use	Transport, application	500
Total Emissions		3000
Biochar Carbon Storage		5000
Net CO2 Removal		2000

4.8 Interpretation:

The results of the LCA should be interpreted to identify significant impacts and areas for improvement. Sensitivity analysis and uncertainty assessment should be performed to ensure robustness and reliability of the LCA results.

5. SPECIFIC REQUIREMENTS FOR STABILITY AND EMISSION CONTROL

Objective: To ensure the environmental integrity of biochar by setting stringent requirements for its stability and controlling emissions throughout the production process.

5.1 Biochar Stability

5.1.1 Stability Metrics:

Molar H/C_{org} Ratio: The molar hydrogen to organic carbon ratio (H/C_{org}) must be lower than 0.7 to ensure high stability and resistance to degradation.

Formula for H/C_{org} Ratio:

$$H/C_{\text{org}} = \frac{H}{C}$$

Where

- H = Hydrogen content (percentage by mass)
- C = Organic carbon content (percentage by mass)

Table 2: Biochar Stability Classification Based on H/C_{org} Ratio

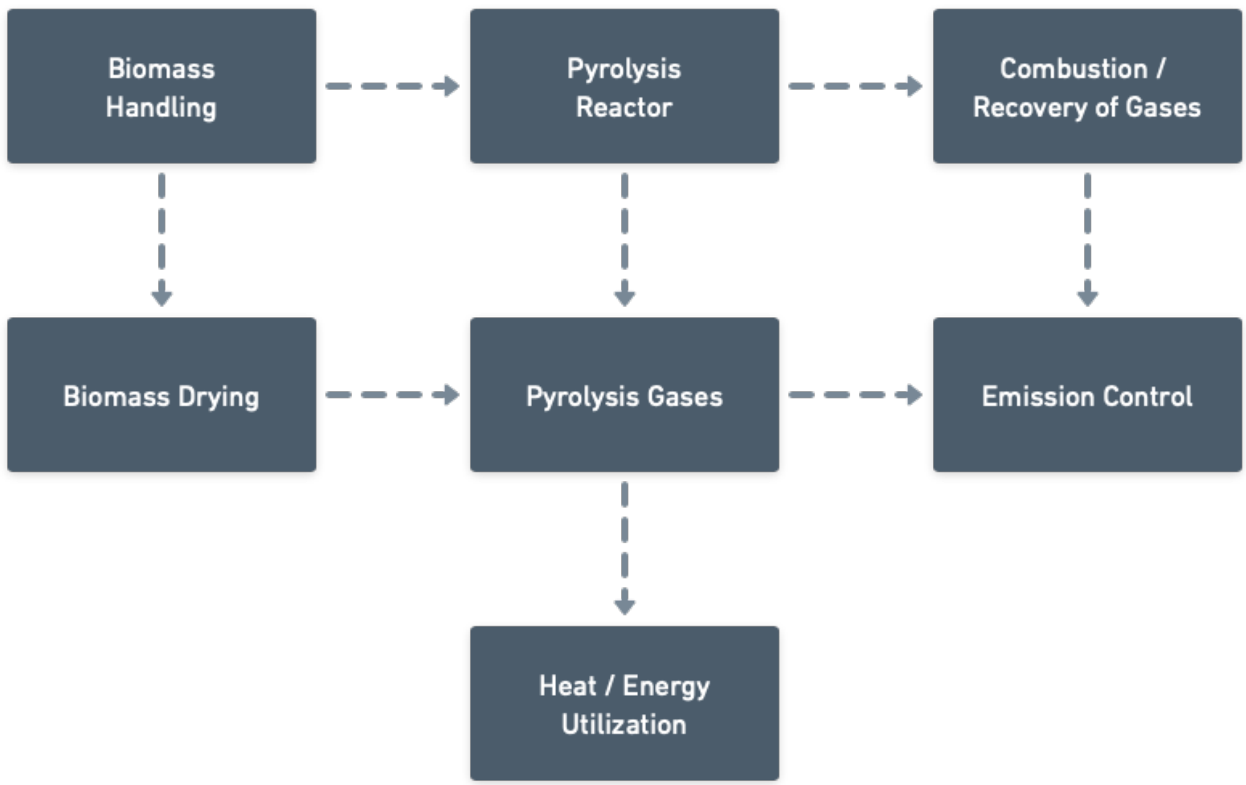
H/C_org Ratio	Stability Level
< 0.2	Very High Stability
0.2 - 0.4	High Stability
0.4 - 0.7	Moderate Stability
> 0.7	Low Stability

5.2 Emission Control

5.2.1 Engineered Emission Control:

- **Combustion or Recovery of Pyrolysis Gases**: Pyrolysis gases must be combusted or recovered to reduce methane emissions to negligible levels.

Diagram: Emission Control Process Flow



5.2.2 Fossil Fuel Use:

- **Permitted Use**: Fossil fuels are allowed for ignition and pre-heating of the pyrolysis reactor.
- **Prohibited Use**: Co-firing of fossil fuels with biomass in the same reaction chamber is prohibited.
- **LCA Inclusion**: Emissions from fossil fuel use must be included in the LCA.

5.2.3 Emission Reduction Strategies:

- **Bio-oil and Syngas**: These by-products should be captured and utilized as renewable energy sources or materials.

5.3 Biochar Quality

5.3.1 Quality Standards:

- Biochar must meet local and application-specific quality standards. In the absence of local standards, biochar should adhere to the International Biochar Initiative (IBI) or the European Biochar Certificate (EBC) standards.

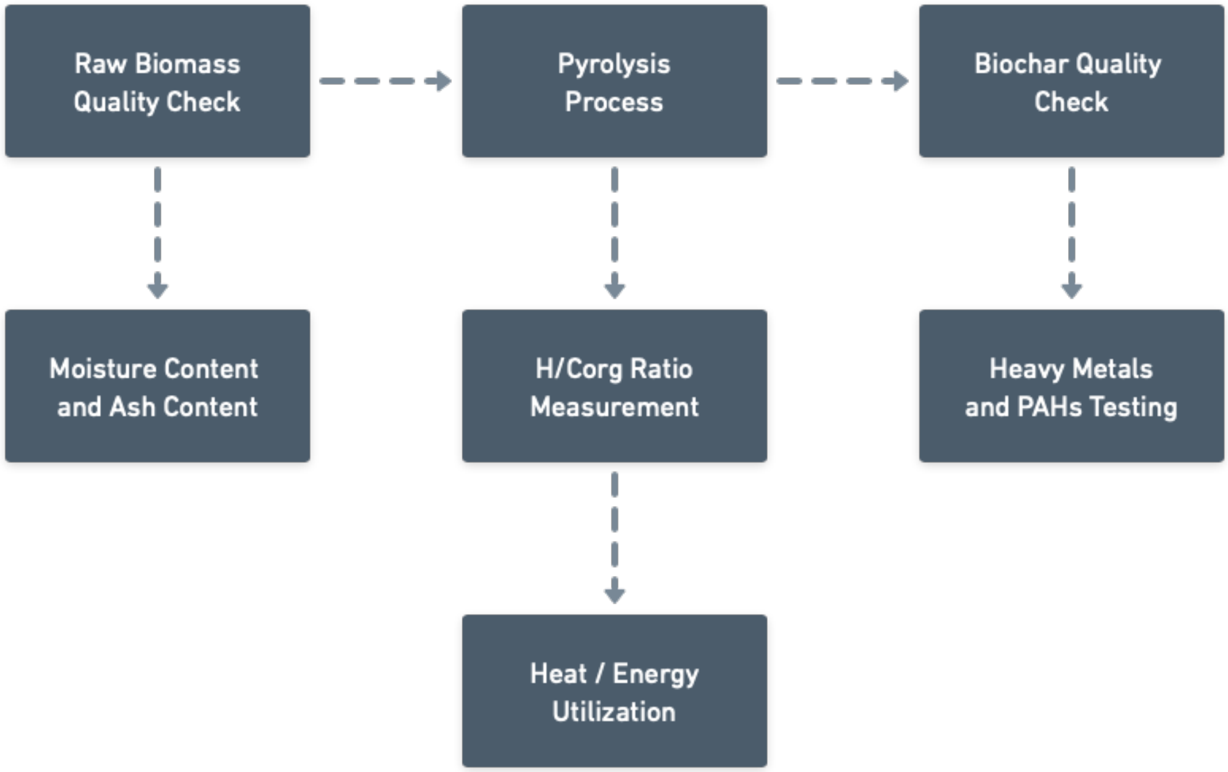
Table 3: Quality Requirements for Biochar

Parameter	Threshold	Testing Method
Heavy Metals	Below regulatory	ICP-MS, AAS
PAHs (Polycyclic Aromatic Hydrocarbons)	Below regulatory	GC-MS, HPLC
Moisture Content	< 20%	Gravimetric
pH	6 - 8	pH Meter
Ash Content	< 5%	Gravimetric

5.3.2 Safety Measures:

- Ensuring safe working conditions and implementing cleaner production principles, including fire prevention, dust control, and proper handling of biochar.

Diagram: Biochar Production Quality Control



5.4 Monitoring and Verification

5.4.1 Continuous Monitoring:

- Continuous monitoring of emissions and biochar quality to ensure compliance with standards.

5.4.2 Third-Party Verification:

- Independent third-party verification of biochar production processes and emission control measures.

5.4.3 Documentation and Reporting:

- Detailed documentation and regular reporting on emissions, biochar quality, and compliance with safety measures.

6. ADDITIONALITY AND SAFEGUARDS

Objective: To ensure that biochar projects contribute genuinely to carbon removal and do not cause social or environmental harm, by setting strong requirements for demonstrating additionality and implementing robust safeguards.

6.1 Additionality

6.1.1 Demonstrating Additionality:

- **Financial Additionality**: Projects must demonstrate that they would not be financially viable without the revenue from carbon credits. This involves providing full project financials and a counterfactual analysis based on conservative baselines.

Formula for Financial Additionality:

$$\text{Additionality Score} = \frac{\text{Total Project Revenue}}{\text{Revenue from Carbon Credits}}$$

- A score greater than 0.2 typically indicates strong financial additionality.

6.1.2 Regulatory Additionality:

- Projects must not be required by existing laws, regulations, or other binding obligations. Projects must provide documentation proving that the activities surpass legal requirements.

Table 4: Additionality Checklist

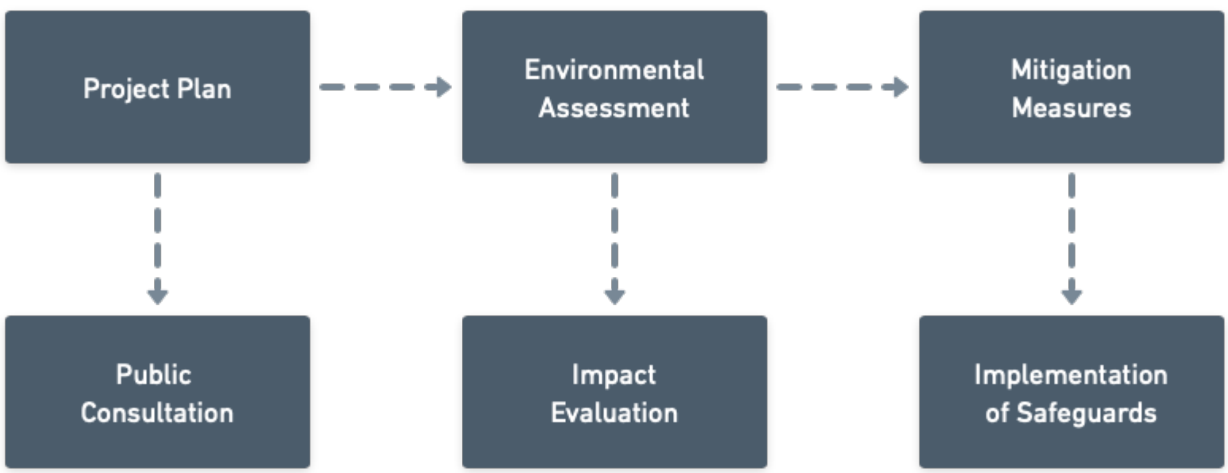
Additionality Criteria	Evidence Required	Verified By
Financial Additionality	Detailed project financials, revenue analysis	Independent auditor
Regulatory Additionality	Legal documents, regulatory filings	Legal expert or consultant

6.2 Environmental Safeguards

6.2.1 Environmental Impact Assessment (EIA):

- Projects must conduct comprehensive EIA's or present equivalent documentation to show no significant harm to the environment. The EIA should cover potential impacts on biodiversity, soil, water, and air quality.

Diagram: EIA Process Flow



6.2.2 Sustainable Biomass Sourcing:

- Biomass must be sustainably sourced, with proof of origin and sustainability certificates required for forest biomass. This ensures that biomass harvesting does not lead to deforestation or habitat destruction.

Table 5: Sustainable Biomass Sourcing Requirements

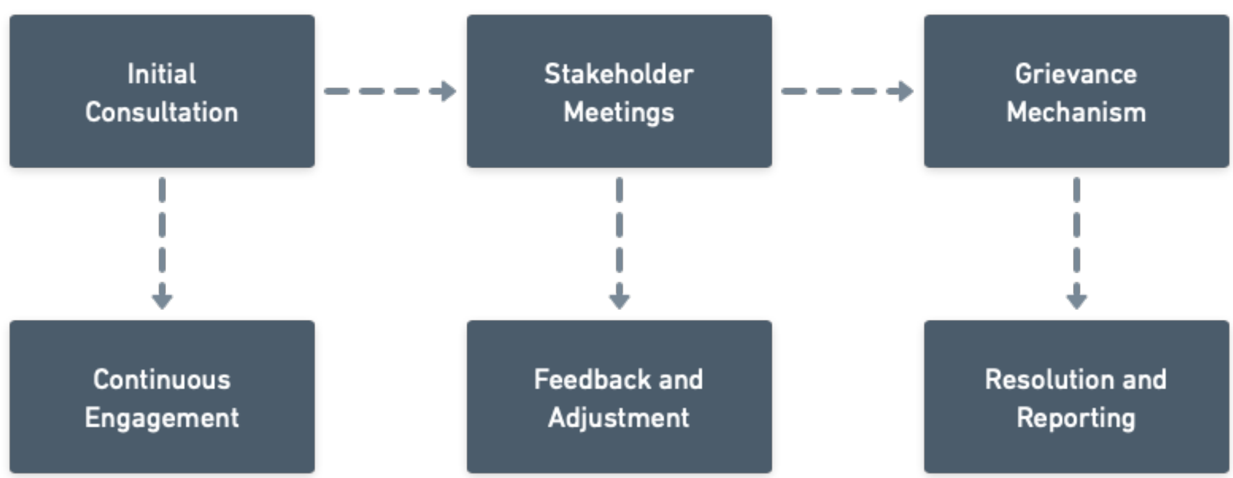
Biomass Source	Certification Required	Verified By
Agricultural Residues	Proof of origin, sustainability certificate	Agricultural auditor
Forest Biomass	FSC or PEFC certification	Forestry auditor
Industrial Hemp	Documentation of sustainable practices	Hemp industry expert

6.3 Social Safeguards

6.3.1 Community Engagement:

- Projects must ensure informed consent from local communities and address potential grievances. Regular engagement and consultation with local stakeholders are essential.

Diagram: Community Engagement Process



6.3.2 Social Impact Assessment (SIA):

- Projects must conduct SIAs to evaluate the potential social impacts and ensure that the benefits are distributed equitably among the community.

6.4 Monitoring and Verification

6.4.1 Continuous Monitoring:

- Continuous monitoring of environmental and social impacts to ensure compliance with safeguards.

6.4.2 Third-Party Verification:

- Independent third-party verification of additionality claims and safeguard measures. Regular audits and site visits are required.

6.4.3 Documentation and Reporting:

- Detailed documentation and regular reporting on additionality, environmental impacts, and social impacts. Reports must be accessible to stakeholders and the public.

7. PROOFS NEEDED FROM TH CO2 REMOVAL SUPPLIER

7.1 Principle

7.1.1. Biochar produced for applications such as burial techniques, orphaned oil well remediation, soil amendment, and biochar concrete must be verified by a third-party auditor to confirm eligibility for CRU issuance. This verification process evaluates whether the biochar production and application adhere to the HCS methodology, including environmental and social safeguards, and confirms the permanence of CO2 removal.

7.1.2. To qualify for CRU issuance, the CO2 Removal Supplier must present comprehensive documentation proving compliance with specific biochar production and application guidelines. These include:

- **Proof of Sustainable Biomass Usage**: Documentation must verify that the biomass used for biochar production is sourced sustainably, aligning with HCS requirements for minimal environmental impact.
- **Biochar Production and Quality Control**: Evidence of consistent production quality that meets HCS standards for biochar, including carbon content and stability, suitable for the intended application.
- **Application Method Documentation**: Detailed descriptions and evidence of how the biochar is applied in the field, such as methods for burying biochar, techniques used for filling orphaned oil wells, incorporation into soil, or how it is mixed into concrete formulations.

7.1.3 Environmental and Social Impact Assessments:

- **Environmental Impact**: Suppliers must provide an environmental impact assessment that outlines the potential effects of biochar production and application on the local environment, including impacts on air, water, and soil quality.
- **Social Impact**: Documentation should include assessments of how the biochar project impacts local communities, ensuring that all practices are sustainable and socially responsible.

7.1.4 Verification and Monitoring:

- **Continuous Monitoring**: Systems must be in place to continuously monitor the biochar production process and its application to ensure ongoing compliance with HCS standards.
- **Periodic Reviews**: Regular audits and reviews are required to maintain CRU certification, with updates provided to certification bodies on compliance and performance.

This enhanced focus ensures that the biochar produced not only sequesters carbon effectively but does so in a manner that is beneficial to both the environment and local communities, adhering strictly to the guidelines set forth by the Hemp Carbon Standard.

7.2 Biomass Production and Supply

7.2.1 Proof of Origin and Sustainability:

- **Industrial Hemp Biomass**: For applications such as burial techniques, orphaned oil well remediation, soil amendment, and biochar concrete, it is critical to verify that the industrial hemp biomass is sourced sustainably. Documentation must be maintained that demonstrates the sustainability of the hemp cultivation practices, including adherence to environmental standards and regulations. This documentation should be robust enough to withstand third-party audits and ensure transparency.

7.2.2 Life Cycle Assessment (LCA):

- **Comprehensive LCA Reporting**: A detailed life cycle assessment for the industrial hemp biomass must be provided by the CO2 Removal Supplier. This LCA should cover the entire process from cultivation through to the delivery of the biomass to the biochar production facility, outlining the associated greenhouse gas emissions.

- **Emission Details**: The LCA must specifically break down emissions related to the cultivation of hemp, including the use of any fertilizers or pesticides, water usage, and the energy consumed during harvesting and processing. It should also cover the transportation of the biomass, detailing the emissions from any vehicles used and the logistics involved in getting the biomass to the biochar production site.

7.2.3 Documentation and Audit Compliance:

- **Record Keeping**: All records pertaining to the sourcing and sustainability of industrial hemp biomass must be thoroughly maintained. These records should include details on the origin of the hemp, any chemicals used during cultivation, and practices employed to ensure minimal environmental impact.
- **Verification Requirements**: These documents must be readily accessible for verification during audits to confirm compliance with the Hemp Carbon Standard. This ensures that the practices involved in biomass production align with the overarching goals of sustainability and responsible resource management.

7.3 Biochar Production

7.3.1 Documentation and Data Trail:

- **Production Records**: Biochar producers must maintain continuous and detailed documentation of biochar production. This includes records of any significant changes or interruptions in production processes.
- **Dry Mass Calculation**: The amount of biochar produced must be quantified accurately. This involves using continuous load cell measurements to track the production volume and calculating the dry mass of biochar by deducting the water content measured during the production process.

7.3.2 Life Cycle Assessment (LCA):

- **Comprehensive LCA**: Producers are required to submit detailed life cycle assessment data for the biochar production process. This data should highlight the climate change impacts, clearly indicating the contributions from different stages of production and the emissions of major greenhouse gases.

7.3.3 Biochar Quality Testing:

- **Laboratory Analysis**: Critical properties of the biochar such as total organic carbon content, total hydrogen content, and the calculated H/C_{org} ratio must be analyzed in accredited laboratories adhering to international standards (e.g., ASTM, ISO).

- **Additional Testing**: Depending on the intended application of the biochar (burial, oil well remediation, soil amendment, or concrete integration), additional properties like PAH and heavy metal content must also be analyzed to ensure compliance with quality and safety standards.

7.3.4 Sampling and Testing Protocol:

- **Representative Sampling**: The biochar sent for laboratory analysis must be representative of the entire production batch. This ensures the consistency and reliability of biochar quality data.
- **Testing Frequency**: The frequency of biochar testing should be sufficient to account for any variability in biomass feedstock and production conditions, ensuring that all biochar produced meets the specified criteria for each application.

7.3.5 Environmental Compliance:

- **Regulatory Adherence**: Biochar producers must comply with all local environmental regulations concerning emissions to air, water, and soil. This includes not only adhering to mandatory legal requirements but also committing to continuous environmental performance improvements.
- **Emission Evaluation**: Producers must conduct and submit evaluations of emissions from their operations, detailing the measures in place to minimize environmental impacts and plans for further reductions.

This section of the methodology ensures that biochar production is conducted in a manner that aligns with environmental sustainability and carbon sequestration objectives of the HCS, particularly focusing on the specific applications that enhance the permanence of carbon storage.

7.4 Biochar Use

7.4.1 Life Cycle Assessment of Biochar Use:

- **Comprehensive Documentation**: Suppliers must provide detailed life cycle assessment data that captures the environmental impact of biochar usage, particularly in relation to climate change. This documentation should include a disaggregated presentation of greenhouse gas emissions associated with each stage of the biochar's lifecycle after production, specifically focusing on its application in burial techniques, orphaned oil well remediation, soil amendments, and concrete.

- **Lifecycle Stages and Emissions**: The assessment should clearly delineate the contributions from transportation, application, and long-term environmental interaction of the biochar within its final use context.

7.4.2 Proof of Intended Use:

- **Verification of Non-Combustive Use**: It must be documented that the biochar is not used as a fuel or reductant, which could lead to the release of sequestered CO2 back into the atmosphere. Acceptable forms of proof include offtake agreements or records of sale and shipment that specify the biochar's use in environmentally stable applications such as burial, structural fills, soil enhancement, or as an additive in concrete.
- **Exclusion of Incineration Risks**: Documentation must also ensure that the biochar is not disposed of in ways that could lead to its incineration, emphasizing its incorporation into stable matrices from which it cannot be readily separated.

7.4.3 Justification of Environmental Conditions:

- **Soil Temperature Considerations**: For biochar used in soil amendments or buried applications, a justification must be provided for the soil temperature parameters used in the sequestration calculations. This ensures that the estimated carbon storage accurately reflects the specific environmental conditions where the biochar is applied.

This section of the methodology ensures that the use of biochar in specified applications under the HCS not only complies with sustainability goals but also contributes effectively to carbon sequestration. The strict monitoring and documentation requirements guarantee that all CRU issuance is based on verifiable and permanent carbon storage, aligning with the overarching objectives of the Hemp Carbon Standard.

7.5 No Double Counting

7.5.1 System of Unique Identification:

- To prevent double counting of Carbon Removal Units (CRUs), a registry with a unique identification system will be utilized. This ensures that each CRU, once issued, is only accounted for once and cannot be claimed multiple times. The registry will maintain detailed records including information on the production facility, registration, crediting period dates, verification, issuance, cancellation transactions, and changes in title and ownership over time.

7.5.2 Marketing and Sale of Biochar:

- CO_2 Removal Suppliers must provide a statement confirming that the biochar, where CO_2 is sequestered, will not be marketed or sold as "climate positive" independently of its associated CRU. If a CRU is decoupled from its physical biochar product and sold separately, the original biochar product cannot be marketed as contributing to CO_2 removal.

7.5.3 Packaging and Branding Requirements:

- There must be a review of how biochar is packaged and branded, particularly if its associated CRU is separated from the physical product. This ensures clarity and honesty in marketing communications, preventing misleading claims about the biochar's environmental benefits.

7.5.4 Restrictions on Marketing Claims by End-Users:

- End-users of the biochar are prohibited from making claims that the biochar is a carbon sink if the CRUs associated with the biochar have been decoupled and sold separately. This policy ensures transparency and maintains the integrity of carbon sequestration claims under the HCS.

These guidelines are designed to uphold the credibility of the biochar production and application processes under the Hemp Carbon Standard, ensuring that each CRU represents a verifiable and unique claim to carbon sequestration.

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