Bringing Biochar Projects into the Carbon Marketplace

An introduction to carbon policy and markets, project design, and implications for biochar protocols.

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Note to Reader

This primer document supports an initiative from Carbon Consulting and Blue Source, along with founding sponsors Carbon War Room and ConocoPhillips Canada, to create a protocol for the development of projects and the quantification of greenhouse gas (GHG) emission reductions across a variety of biochar projects and technologies. The primer is not intended to be comprehensive but rather to serve as a common basis and framework to facilitate discussion throughout the initiative. This initiative will ultimately utilize industry expertise to develop a comprehensive, broad-scope framework for a biochar methodology.

This protocol development project is being completed in the public domain, including resource materials and events to solicit input from the biochar and carbon finance communities on the science and policy implications behind biochar. We encourage all interested stakeholders to become involved, and we ask that you take the time to read this document in its entirety. This will build an educated constituency to support the biochar protocol development process and ensure that your valued input is most effectively utilized.

Our goal is simple: to open carbon markets to biochar and pyrolysis technologies.

For more information on this initiative, please visit our website at: www.biocharprotocol.org.

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Glossary

Additionality
Measure of whether a project is incremental to the business-as-usual case. Often used as a key measure of whether a project should be considered eligible for the creation of carbon offset credits. This term has different definitions and uses across carbon offset systems.

AFOLU
Used under the VCS and otherwise to describe Agricultural, Forestry and Other Land Use projects. These projects involve processes and practices that impact the carbon and nitrogen cycles across a landscape.

AOS
Alberta Offset System, the regulatory regime for offset credits in Alberta.

Aggregation
The practice of bundling small offset projects to overcome the economies of scale associated with carbon offset documentation, certification, and commercialization.

Carbon offset or credit
Offsets or credits are the generic units used to describe the verified and certified reduction or sequestration of one tonne of carbon dioxide equivalents (CO_2E).

Carbon offset system
Voluntary or compliance-based program for the certification and recognition of carbon offsets. These programs are typically broadly scoped across project types with codified rules designed to accommodate a diverse set of interests.

CDM
Clean Development Mechanism, the carbon offset certification body established under the Kyoto Protocol for projects implemented in developing nations.

Double-counting
The attribution of a GHG emission reduction or sequestration benefit multiple times. This is a significant concern for ensuring the integrity of carbon offset systems.

GHG
Greenhouse gas, typically including the six common gases of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). All GHGs can be related back to a common unit of CO_2E by multiplying the emissions of a given gas by its global warming potential.

Leakage
Term used to describe a situation where an emission reduction measured in one instance results in a measurable increase in emissions elsewhere.

Methodology
A quantitative approach to analyzing the emission reductions from a given project. Methodologies are embedded within a protocol and may otherwise lack the overlay of the applicable carbon offset system guidelines.

Permanence
A measure of whether the carbon emission reduction or sequestration has a lifespan greater than or equal to the lifespan of a GHG in the atmosphere. Permanence of reversible emission reductions or sequestration opportunities is assessed differently across carbon offset systems.

Protocol
A codified quantification methodology approved by a carbon offset system suitable for use as a carbon market access mechanism. Protocols include a quantification methodology and the overlay of carbon offset system guidelines, within a given document format. Each carbon offset system has a development and approval process for protocols.

VCS
Voluntary Carbon Standard, an international standard for use in the voluntary carbon markets. Largely viewed as a pre-compliance standard in the United States.

1. Biochar Protocol Development's Vision

The responsible deployment of biochar will make a significant positive impact in the fight against global warming by offering a strategy to draw down carbon dioxide from the atmosphere. To accelerate the delivery of this impact, we will open up carbon markets to biochar and pyrolysis technologies by creating a protocol for the development of projects and quantification of greenhouse gas emission reductions and removals. This public-domain protocol will be applicable across a wide variety of biochar projects and technologies, enabling even small-scale projects to be rewarded for their contribution to withdrawal of carbon dioxide from the atmosphere.

2. Introduction

A multi-stakeholder effort has been launched for the development of a comprehensive GHG emission reduction and sequestration quantification protocol for biochar projects. The resulting protocol is to be submitted for approval under the Voluntary Carbon Standard and the Alberta Offset System, with the vision of then being leveraged into other current and emerging GHG offset systems. To that end, the protocol will provide biochar project developers with guidance and the market infrastructure to access the potential value from current and emerging carbon markets.

Prior to developing the protocol documents, an open stakeholder consultation process is being undertaken to support discussion of the key science, technical and protocol-specific issues. Primer documents like this one will support discussion of these issues; the second will focus on the science and technical issues, and this primer focuses on protocol-specific issues.

For more information on this initiative, please visit www.biocharprotocol.org.

3. Background

The following sections provide a high-level overview of the range of potential biochar projects and their relevance within existing and emerging carbon markets. It is on the basis of this fit that the initiative to develop a GHG emission reduction quantification protocol is being pursued. To ensure optimized public participation in the protocol development process, a solid grounding in the basic concepts of biochar projects and carbon markets is of paramount importance.

3.1 Background on Biochar

Growing plants draw down atmospheric carbon dioxide to produce carbon-containing biomass. During plant death and the decomposition of organic material, carbon stored in biomass is re-released to the atmosphere within a matter of month to years, dependent upon various factors. This carbon would be emitted as carbon dioxide if decomposition occurs under aerobic conditions. Under anaerobic conditions, the emissions from the decomposition of biomass come in the form of methane – a greenhouse gas 21 times more potent than carbon dioxide. A portion of nitrogen contained in biomass feedstocks would be lost either directly or indirectly as nitrous oxide – a greenhouse gas 210 times more potent than carbon dioxide.

Creating biochar through the process of pyrolysis locks in and stabilizes the carbon that decomposing plants would otherwise release into the atmosphere. This process therefore presents an important opportunity to remove carbon from the atmosphere.

During pyrolysis, biomass, such as plant residues or animal wastes, is heated in an oxygen-deprived environment, causing thermal decomposition of the organic matter to produce biochar. Beyond the benefits of capturing carbon, pyrolysis by-products may be used to produce energy products such as liquid fuels, heat, and electricity. Biochar can be added to soil, where it continues to store carbon and enhance soil quality. Using biochar on farm fields can increase agricultural production without increasing cropped area, all the while reducing fertilizer and water inputs.

The gigaton-scale offset opportunity from biochar will likely be developed through a relatively small number of "platforms" representing distinct configurations of biomass feedstocks, pyrolysis technologies, and biochar and energy products at a range of scales.

- Small-scale biochar and pyrolysis development may include such approaches as exchanging open flames for more efficient household pyrolysis stoves and applying the char by-product to adjacent farmland in developing nations.
- Medium-scale developments may include portable pyrolysis systems for the management of on-site logging wastes after harvesting has been completed.
- Large-scale biochar and pyrolysis developments may include waste management within major bio-energy industries, such as the sugarcane-to-ethanol or the palm oil industries, or manure management at large-scale livestock operations.

3.2 Biochar's Fit with Carbon Markets and Policy

The production and use of biochar offers great potential for GHG emission reductions and the removal of carbon dioxide equivalent (CO_2E) from the atmosphere through carbon sequestration and renewable energy production. For biochar projects to capture the full value of these benefits, thereby maximizing one of biochar's value streams and an economic driver for biochar projects, there is a need for a definitive GHG quantification protocol.

Addressing climate change will require strategies that reduce both the rate of carbon dioxide and GHG emissions and also the amount of carbon dioxide in the atmosphere at a gigaton scale in a rapid and sustainable manner. The implementation of biochar production and pyrolysis technology in a carbon capture and

carbon credit market framework will provide an excellent opportunity for expanding the portfolio of current climate change mitigation measures while also creating alternate streams of revenue and industrial opportunity for agricultural and waste management sectors. Further economic benefits could be extended into developing nations through pyrolysis stove technology and an increased contribution to sustainable and carbon-neutral development.

Platforms representing distinct configurations of biomass feedstocks, pyrolysis technologies, and biochar and energy products will drive forward this industry. Resulting revenue streams may come from tipping fees (e.g. savings in fees and taxes by diverting waste materials from landfills) or other cost savings associated with feedstock processing (e.g. diverting waste materials from landfills); biochar-as-soil-amendment sales; energy product sales; and revenues from carbon offsets. The range of project types, scales and outputs must be considered to allow for a reasoned and strategic development of a suitable and rigorous broad-scope protocol.

To enable biochar to access the carbon offset markets, an approved GHG emission reduction quantification protocol that meet the needs of such projects must be developed. Within the North American context, two opportunities for industry-led GHG protocol development are of particular interest: the Voluntary Carbon Standard (VCS) and the Alberta Offset System (AOS). Protocols for these systems are required to meet the ISO 14064-2 standard. Taking the variance of carbon market standards into consideration, a protocol under either the VCS or AOS could be leveraged into voluntary and regulated carbon markets across North America and globally, leading to great future opportunities for biochar development.

The development of universally applicable biochar protocols for carbon capture and storage will enable biochar stakeholders developing projects at a variety of scales and using diverse feedstocks to meet and participate in the VCS and AOS markets. Further, these protocols can then be leveraged into international markets. The public domain and comprehensive nature of the protocol documents will then provide all biochar project developers with an opportunity to take advantage of the burgeoning carbon market and play an important role, with less initial overhead allocated to protocol approval relative to developing a series of project-specific methodologies.

4. Carbon Policy and Markets

The following sections outline the various carbon policy frameworks and market regimes that are relevant within the North American context. Since each of these systems continues to evolve in real-time, only brief summaries of the relevant initiatives are included, with links provided to the most current sources of information.

4.1 Carbon Policy Frameworks

Each of the following policy frameworks is evolving to support voluntary and compliance

offset markets in North America. These policy frameworks largely define and support demand for the offsets from the various project types, such as biochar projects.

4.1.1 US Policy

The following section outlines the key US policy frameworks under consideration and development.

Western Climate Initiative

The Western Climate Initiative (WCI) includes seven US states and four Canadian provinces: Arizona, California, Montana, New Mexico, Oregon, Utah, Washington, British Columbia, Manitoba, Ontario, and Quebec. There are numerous other jurisdictions in Canada, the US, and Mexico that are observers of the WCI. The objective is of the WCI is a 15% reduction in GHG emissions from 2005 levels by 2020 using a cap-and-trade approach, to commence January 1, 2012.

The policy favors a phased-in approach, including:

- Electricity generation, including imported electricity (2012)
- Industrial and commercial fossil fuel combustion (2012)
- Industrial process emissions (2012)
- Gas and diesel consumption for transportation (2015)
- Residential fuel use (2015)

Entities will have a number of options for meeting compliance, including achieving internal reductions, allowable auctions and allocations of allowances, and offsets from projects. These offsets can provide up to 49% of any entity's compliance obligation. WCI partner jurisdictions may approve and certify offset projects located throughout the United States, Canada, and Mexico where such projects are subject to rigorous oversight, validation, and verification relative to a defined protocol.

www.westernclimateinitiative.org

Regional Greenhouse Gas Initiative

The RGGI is a cooperative effort by 10 Northeast and Mid-Atlantic States to limit GHG emissions. RGGI applies to the electricity generation sector only in the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. These 10 states have capped CO_2 emissions from the power sector such that emissions will be stabilized at 188 million tonnes from 2009 to 2014 and then reduced by 2.5% each year to 2018 to achieve a 10% reduction by 2018.

Eligible offset projects can be used as a mechanism for entities achieving compliance. These offsets may come from projects in any participating state, or any other state or US jurisdiction in which a cooperating regulatory agency has entered into a memorandum of understanding with the participating states. The emission reductions must rely on a defined protocol.

http://www.rggi.org/home

The Midwestern Greenhouse Gas Reduction Accord

The MWGA is comprised of six US States and one Canadian province: Illinois, Iowa, Kansas, Michigan, Minnesota, Wisconsin, and Manitoba. It has set an emission reduction policy target of 20% below 2005 levels by 2020 and 80% below 2005 levels by 2050. The MWGA plans to

introduce a cap-and-trade approach starting January 1, 2012.

All facilities emitting greater than 25,000 tonnes from the following activities are included:

- Electricity generation, including imported electricity (< 25 MW are exempt)
- Industrial fossil fuel combustion
- Industrial process emissions (if credible measurement protocols exist)
- Other residential, commercial, industrial fuel use
- Transportation fuels

These facilities have three compliance options, including internal reductions, allowable auctions and allocations, and domestic and international offsets. Currently, little guidance is available on the certification and use of offsets.

http://www.midwesternaccord.org

United States Federal Legislation

There have been a number of federal legislative initiatives in the US in support of regulating GHG emissions. In 2009, the American Clean Energy and Security (ACES) Act passed the US House of Representatives by a narrow margin. Subsequently, there has been pressure to get a bill through the Senate that could be reconciled with the House bill. Most recently, the American Power Act (APA) was brought forward in draft form by Sen. John Kerry and Sen. Joseph Lieberman.

In broad terms, under the various federal legislative approaches being considered, it is largely contemplated that various sectors of the US economy would be phased into the regulation between 2012 and 2016. Offsets would play a substantive role as a cost containment mechanism. The offsets would include domestic projects covered under US EPA and USDA approved protocols, and international sources of offsets.

http://www.pewclimate.org/acesa
http://kerry.senate.gov/americanpoweract/pdf/APAbill.pdf

California

The California Air Resources Board released draft regulations in November 2009 to carry out the state's A.B. 32 bill (Global Warming Solution Act of 2006). This bill strives to reduce GHG emissions to 1990 levels by reducing emissions by 30% by 2020. A.B. 32 would serve as the enabling legislation for California's participation under the WCI. This bill is currently subject to a ballot initiative seeking to have it repealed or suspended pending reductions in unemployment rates for the state.

http://www.climatechange.ca.gov

4.1.2 Canadian Policy

The following section outlines the key Canadian policy frameworks under consideration and development.

Alberta

Alberta was the first jurisdiction in North America to impose regulations requiring facilities that emit more than 100,000 tonnes of GHGs a year (Large Final Emitters (LFE)) to reduce their GHG emissions relative to an intensity baseline. These LFE's are required to reduce their emissions intensity by 12% annually starting in July 2007.

The development of a carbon compliance system, allowing emission offsets as a compliance option, is one of several actions

outlined by the Alberta Government in the Climate Change and Emissions Management Act (2007). There are three regulations under the act currently in effect:

- Specified Gas Reporting Regulation - reporting requirements for large emitters in the province
- Specified Gas Emitters Regulation- includes targets for regulated entities and guidelines for achieving compliance
- Administrative Penalty Regulation- provides information on penalty for non-compliance with the Climate Change and Emissions Management Act

An LFE facility has opportunity to create internal reductions and produce Performance Credits if it is successful in reducing its GHG emissions beyond the regulated requirement. If the facility fails to reduce its emissions below the set target of 12% annually it can choose to buy offset credits (using approved protocols and limited to Alberta-based projects only), or it can contribute to the Climate Change and Emissions Management Fund (currently unlimited access at $15 per tonne).

http://carbonoffsetsolutions.climatechangecentral.com

Saskatchewan

Saskatchewan released Bill 95: Management and Reduction of Greenhouse Gases Act in spring 2010. The act is similar to the regulations in Alberta and has a proposed GHG reduction target of 20% reduction by 2020. The baseline, timeframe and characterization of regulated emitters remains to be determined, and regulated emitters will be required to meet prescribed GHG reduction targets annually.

The vompliance mechanisms would include offsets, pre-certified investments, and early action credits. A failure to meet reduction targets would result in carbon compliance payment (currently anticipated at $15CAD to $25CAD per tonne). There is some preliminary discussion around harmonizing with the Alberta regulatory framework.

http://www.gov.sk.ca

British Columbia

British Columbia has developed myriad policies and regulations to address climate change. These policies include the introduction of an escalating carbon tax, a program to ensure all public sector organizations (PSOs) are carbon neutral and a cap-and-trade program to support their participation in the WCI. The climate change plan is encapsulated with the Climate Action Plan available from http://www.livesmartbc.ca/attachments/climateaction_plan_web.pdf. Although the carbon tax is already in place, other elements of the action plan will come into effect over time.

To support the goal of all PSOs being carbon neutral, the Pacific Carbon Trust (PCT) was established as a Crown corporation of the government of British Columbia. The PCT is mandated to deliver BC-based GHG offsets to help clients meet their carbon reduction goals and to support growth of this industry in BC. PCT is the sole supplier of offsets for the British Columbia PSO's carbon neutral commitment, as well as providing offsets to its private sector clients. The projected carbon offset demand across all PCT clients is up to 1 million tonnes per year. Currently, PCT is willing to transact based on protocols approved under other systems such as the AOS or the VCS.

http://www.env.gov.bc.ca/cas

http://www.pacificcarbontrust.com

Ontario

Ontario is a signatory to the WCI and is an observer of the RGGI and the MWGA. It remains committed to the WCI process in the absence of a federal Canadian or US-Canada continental system. Ontario has put in place GHG reporting regulations that take effect in 2010. Facilities emitting more than 25,000 tonnes annually have to report, with voluntary reporting for facilities emitting above 10,000 tonnes per year.

Ontario has also passed enabling legislation under the WCI to implement a cap and trade system. Along with BC, Quebec, Manitoba and California, they are the only other jurisdictions that have met the WCI timeline on this to date. Ontario is a member of IPOG, the Industry Provincial Offset Group, and has been involved in offset protocol development and adaptation for use in Ontario. Ontario has hinted at putting early guidance in place for an offset system to provide advanced clarity for project developers and LFEs.

http://www.ene.gov.on.ca/en/air/climatechange/doing.php

Canadian Federal Legislation

Development of the Canadian federal system for addressing GHG emissions is generally considered to be on hold, pending developments in the US. There have been various initiatives to engage sectors in setting targets, including recent activity with the fossil-based electricity producers. There have also been several sets of draft guidelines released that cover aspects of a policy framework. However, none of these materials are considered to be current and relevant for planning purposes.

Canada will not meet its obligations for emission reductions as a signatory to the Kyoto Protocol. Thus, the VCS (discussed below under markets) has elected to acknowledge projects from Canada. Further, there is internal pressure in the form of opposition party bills to force the current minority government to develop a comprehensive GHG policy framework. However, the most advanced of these bills is not likely to pass the Senate.

http://www.climatechange.gc.ca

4.2 Carbon Markets

The following section outlines the key carbon markets across North America.

Alberta Offset System

The AOS is a compliance system that accepts verified emission reduction offset credits from Alberta-based projects that are verified against an approved protocol. These projects must be located in Alberta and have started after January 1, 2002. Credits are eligible from 2002 onward, with an allowable crediting period of up to eight years and an opportunity to renew once. The credits may only be surplus to legal requirements.

There are currently 29 eligible protocols under the AOS – 25 of which were authored by Blue Source. The protocol review and approval process has four stages and is largely industry-led. The first three stages of review include technical, broad-stakeholder and public comment periods. The last stage of review is internal to government.

http://carbonoffsetsolutions.climatechangecentral.com

Voluntary Carbon Standard

The VCS is a voluntary reserve that accepts global projects. Participation is voluntary and based on objective criteria. The standard is based on the requirements in ISO 14064-2:2006, ISO 14064-3:2006, and ISO 14065:2007. The current applicable program guidelines were released 18 November 2008 and are labeled as VCS 2007.1, fully integrating the requirements for agriculture, forestry, and other land use change projects into the VCS program.

The scope of the VCS program covers all those activities related to the generation of GHG emission reductions and removals. The VCS has approved the following programs; UNFCCC Clean Development Mechanism (CDM), UNFCCC Joint Implementation (JI), and the Climate Action Registry (CAR). All approved protocols under these aforementioned programs are accepted under VCS (an exception - CAR forestry protocol is not accepted currently).

Sectors currently accepted under the VCS:

- Energy industries
- Energy distribution
- Energy demand
- Manufacturing industries
- Chemical industry
- Construction
- Transport
- Mining/mineral production
- Metal production
- Fugitive emissions from fuels
- Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride
- Solvents use
- Waste handling and disposal
- Agriculture forestry and other land use
- Livestock, enteric fermentation, and manure management

Protocol development under the VCS is industry-led, with a double validation process to ensure rigour. All new protocols must be validated by two independent and accredited validators. There is also a public comment period to ensure broad stakeholder engagement.

www.v-c-s.org

American Carbon Registry

The ACR is a privately owned, nonprofit voluntary and pre-compliance market that was founded in 1997. It accepts protocols or methodologies published by the CDM and ACR-approved methodologies from both the U.S. Environmental Protection Agency (EPA) Climate Leaders Program and the VCS, to the extent that they comply with ACR's Standards. ACR also gives project proponents the flexibility to propose modifications to ACR-approved methodologies and tools. Offsets are branded as Emission Reduction Tonnes (ERTs), and ACR accepts worldwide projects. The ACR currently has two unrelated published methodologies for use and several under development.

http://www.americancarbonregistry.org

Climate Action Reserve

The CAR is a California-based, national offsets program that accepts projects from any state within US jurisdiction. CAR was established through the California Climate Action Registry (California Registry originally established in 2001) to address climate change through voluntary calculation and public reporting of emissions.

The reserve has a selection of internally approved offset project protocols that are designed to be consistent with the principles,

requirements, and guidance of two overarching standards for project-based GHG accounting:

- International Organization for Standardization (ISO) 14064, Part 2; and
- The World Resources Institute/World Business Council for Sustainable Development (WRI/WBCSD) Greenhouse Gas Protocol for Project Accounting.

Both standards contain consistent general requirements for quantifying reductions in GHG emissions (or increases in carbon sequestration) that result from project-based activities. CAR combines these two standards to create its program documents. Projects are assessed for eligibility on two main areas – a legal requirement test (the project must be above and beyond legal requirements), and a performance standard test (the project must be additional to business as usual conditions).

CAR develops protocols internally through a stakeholder engagement process, with final approval from the CAR board. There are currently eight CAR protocols available to use for US projects. Once a project is accepted by the reserve, it is legally bound to adhere to the rules and regulations of the reserve for the entirety of its crediting period. Once a project is approved, the emission reduction offsets can be traded as Climate Reserve Tonnes (CRTs).

www.climateactionreserve.org

Clean Development Mechanism

The CDM was established as a result of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (2005). To encourage the private sector and developing countries to contribute to emission reductions efforts, negotiators of the Kyoto Protocol included three market-based mechanisms, one of which was the CDM. The CDM allows emission-reduction (or emission removal) projects in developing countries to earn Certified Emission Reduction (CER) credits, each equivalent to one tonne of CO_2. These CERs can be traded and sold, and used by industrialized countries to a meet a part of their emission reduction targets under the Kyoto Protocol.

The CDM stimulates sustainable development and emission reductions while giving industrialized countries some flexibility in how they meet their emission reduction limitation targets. CDM has been in operation since 2006 and offers a wide spectrum of methodologies for project submission.

http://cdm.unfccc.int

Gold Standard

The Gold Standard is a best practice methodology and a high quality carbon credit label for both Kyoto and voluntary markets. Development of the Gold Standard was led by a core group of stakeholders, including World Wide Fund for Nature (WWF), SouthSouthNorth (SSN), and Helio International. The Gold Standard is based in Switzerland, was established in 2006, and is positioned to cover both CDM and VCS certified emission reductions, providing an additional layer of review.

The Gold Standard Registry is developed and maintained by APX Inc. A project can be developed using either one of the Gold Standard published protocols (six protocols and three in development), or Gold Standard status can be obtained via seeking approval of an approved and published CDM methodology.

http://goldstandard.apx.com
http://www.cdmgoldstandard.org

4.3 Market Access Mechanisms and Protocols

To participate in the GHG offset markets, a project must be verified relative to an applicable GHG emission reduction quantification protocol. Protocols provide the specific guidance for quantification of emission reductions from project-based activities in order to substantiate verifiable claims for offsets. As such, these protocols serve as an access mechanism to primary carbon offset markets. The use of the protocols is then guided by the overall policy and market frameworks to ensure offsets are generated that meet the requirements of the relevant regime.

Given the variety of policy and market approaches, there are numerous sets of protocols being developed or under development. At a macro-scale, there appears to be a convergence in the structure and quantification approaches in these protocols. However, the various policy and market overlays have dictated some differences both in protocol content and approval processes.

In terms of protocol frameworks, there has been a general evolution of protocols toward an ISO 14064 pt II approach. The ISO 14064 standard provides a high-level approach for developing protocols. This approach is based on the systematic and comprehensive identification and analysis of the sources of emissions, carbon sinks and carbon reservoirs. The CDM may be the only notable exception to the move toward ISO 14064 pt II compliance.

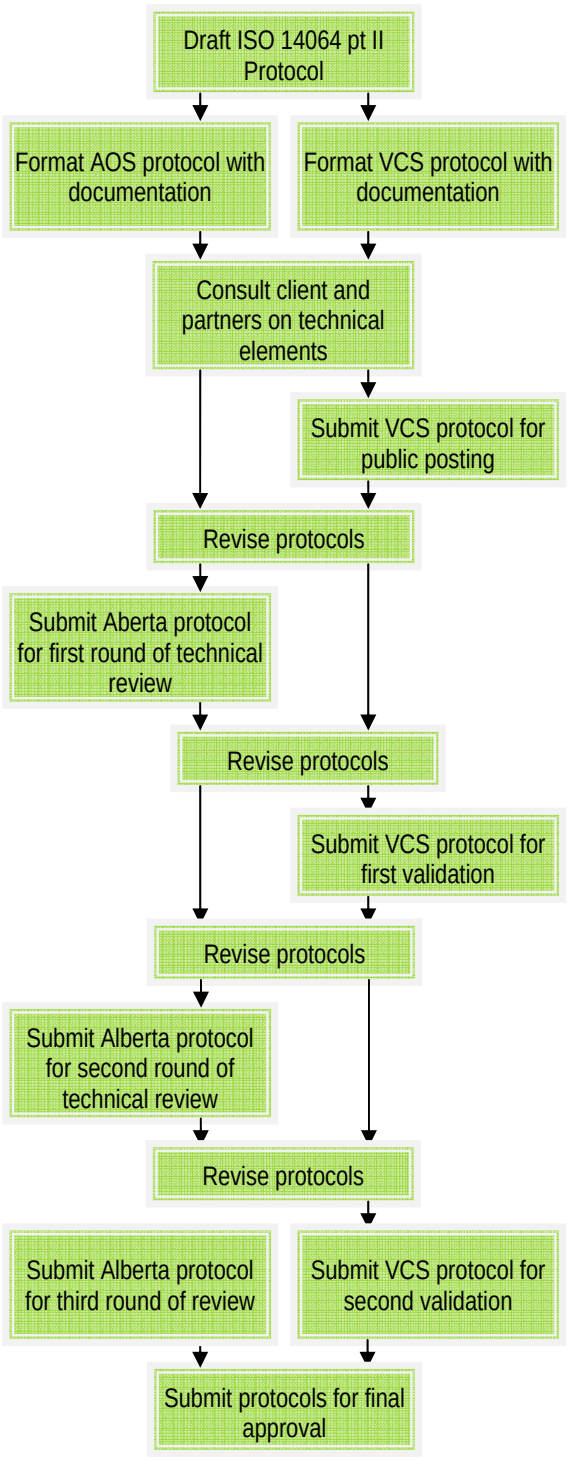
Quantification approaches are increasingly moving toward an in-depth grounding in the relevant peer-reviewed literature as well as national and international best practice guidance (ex. Intergovernmental Panel on Climate Change). This puts increasing responsibility on protocol developers to demonstrate a thorough scientific analysis, ensuring that the quantification methodology conforms to these varied, evolving sources of information. This can be challenging for areas where the science is emerging or where there may be disparate approaches to quantification. As such, broad consultation with science, technology and GHG quantification experts is increasingly valued in protocol development.

For each of the policy and market systems, there is a protocol development and/or review framework. As an example, only those protocols approved following Alberta Environment's review process are applicable for projects seeking to generate offsets under the AOS. However, there is a general view toward the consolidation of protocol quantification outcomes such that a project would be expected to yield comparable offsets under any protocol once the policy and market overlays are accounted for. However, for some specific issues, such as a mechanism for addressing permanence in biological carbon sequestration projects, there remains significant discord and discussion. As such, an in-depth rationale should be included in a protocol to address any issues where there are differences in treatment across various systems.

In consideration of the above, developing protocols is a targeted exercise that involves bringing together project-specific scientific knowledge with GHG quantification expertise. Further, this effort must be focused within a framework (most broadly, ISO 14064 pt II), and fit within the applicable policy and market regimes. This often includes a consideration of the geographic distribution of projects, the time required for protocol development and approval, and the cost of protocol development. These costs must be weighed relative to the relevant benefit from the resultant offset value.

In light of the previous review of offset systems and the overall objective of creating a comprehensive protocol for biochar projects, it is deemed that the VCS and AOS provide the best options for the development and approval of an offset protocol. These protocol development processes are both industry-led, whereas other systems would require systematic approval for the concept of a biochar protocol and may be subject to programmatic prioritization and resource constraints. Similarities between the frameworks allow that a protocol document could be designed to meet the requirements of both markets, simultaneously, achieving some efficiencies. The staged approval processes in both the VCS and AOS would support parallel review. Further, the costs associated with protocol development under these regimes are reasonable, known, and can be recovered, with a low degree of risk due to the established nature of the markets, and relative to the corresponding potential offset volumes and values.

Figure 1 VCS and AOS Review Process



5. Considerations for Protocol Development

The objective of this initiative is to develop a comprehensive protocol covering a range of project types and feedstocks. Therefore, there is a need to invest the time and resources on the front end of the venture in order to ensure a common understanding of the key issues that will underlay the protocol development process.

For this primer, the science and technical issues have been omitted as they are covered separately in the second primer for this initiative. The remaining protocol scoping and GHG accounting issues are outlined in the following sections.

5.1 Scope of Biochar Projects

Biochar projects can range from small installations within individual houses to large industrial projects. Although there can be similarities in technology, feedstock, and outputs across this range of projects, issues associated with project scale can affect protocol development. By way of example, larger projects may be able to support more detailed measurement and monitoring of the relevant parameters for GHG quantification. Small-scale projects may not support the same level of monitoring on an individual basis and may rely on the achievement of economies of scale through aggregation to support quantification and commercialization of the GHG benefits from the project.

As such, it is necessary to consider the range of project types that are to be included within the scope of a protocol. This may not require specifically excluding other projects, or in any other way discounting the environmental benefits from these projects. However, this may point to follow-up work to bring these other projects within the scope of a given protocol, or it may necessitate development of a protocol for projects on a different scale. For example, under the CDM there are full- or large scale methodologies and small-scale methodologies, recognizing different measurement and monitoring requirements.

At the onset of the protocol development process, it is not seen as necessary to specifically exclude any scale of project. However, there is a need to ensure that the protocol provides the most rigorous quantification approach. This will typically support a potential bias toward developing the protocol with a particular focus on large-scale projects. However, careful attention will be required to ensure that smaller-scale projects, including pilot-scale projects, are not *de-facto* excluded.

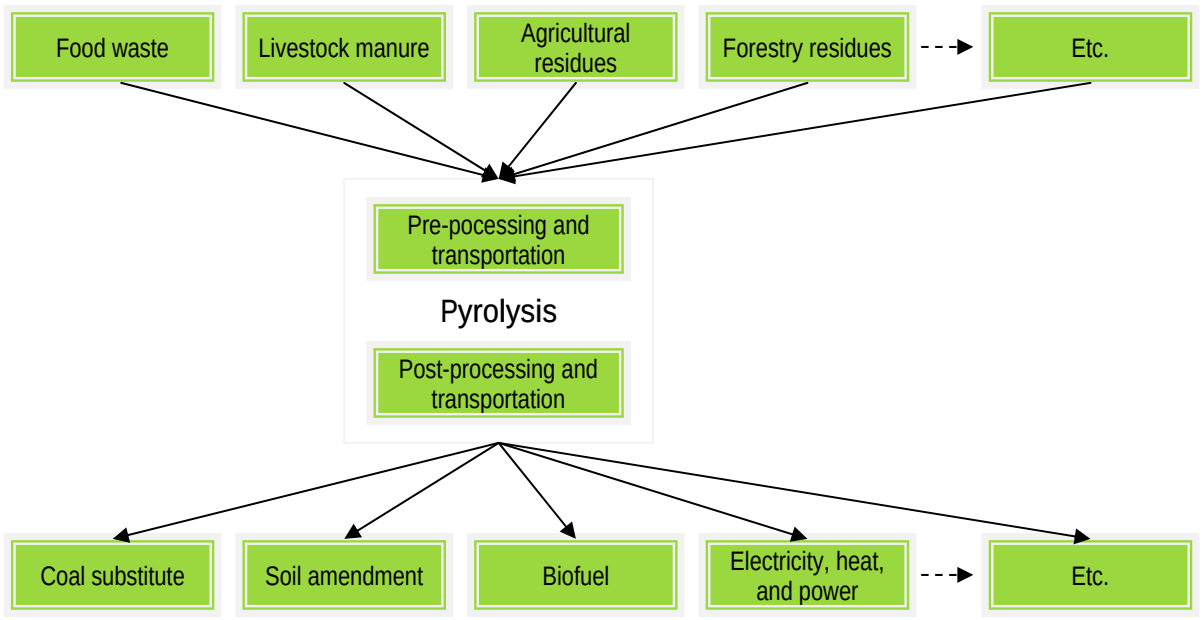
5.2 Project Configurations and Platforms

Irrespective of project scale, biochar projects can contemplate a wide range of feedstocks, processes/technologies, and outputs. Further, the sources of the feedstocks will vary, as will the alternative uses for these materials. The biochar processes may vary in their treatment of the material, including pre-processing (e.g. uniformity of material entering system), process temperature and duration, and post-production processing. The various outputs from a biochar project (biochar and energy co-products) will vary in their characteristics and applications. As projects may include multiple and varying feedstocks and outputs, the complexities of the analysis can increase exponentially.

The International Biochar Initiative (IBI) provides a number of comprehensive resources that define in more detail the range of feedstocks, technologies and output uses. This includes a "Biochar Pathways Matrix" which is very useful in understanding how these elements can be brought together. These materials are available from the IBI website, www.biochar-international.org/technology.

All of these permutations of feedstock, technology and outputs must be structured within a framework to ensure due consideration and broad coverage within the protocol, where possible. Figure 2 provides a conceptual framework for consideration of the various feedstocks, processes, and outputs from biochar projects for the purposes of supporting protocol development. Although not a complete summary on its own, when paired with the various IBI resources, this framework provides broad coverage across the range of project configurations. The diagram is silent on project scale as it is the intent to consider projects of all scales within the analysis.

Figure 2 Project Configurations



Selecting various sets of feedstocks, processes, and outputs, individual biochar project platforms are established. Consideration of biochar project platforms provides a streamlined view of how biochar projects can establish replicable measurement and monitoring requirements. The selection of feedstocks and outputs to include within a given protocol would reflect the range of platforms that the protocol is able to support.

5.3 Sources of Emission Reductions and Carbon Sequestration

The sources of emission reductions and carbon sequestration can vary among biochar projects. They are tied to the particular feedstocks utilized (i.e. how those feedstocks would be utilized under business-as-usual), the processing of the material and the use of the outputs. In addition, there can be a carbon policy and market overlay that influences the analysis.

In broad terms, the following table, Table 1, provides an overview of each of the key emission reduction mechanisms that may apply to biochar projects.

Table 1 Emission Reduction Mechanisms			
Emission reduction mechanisms	Description	Key issues	Analogues
Waste diversion	Organic materials diverted from landfills would otherwise degrade anaerobically, producing methane emissions.	Various models exist for predicting the methane emissions from these sources. However, proving diversion can be challenging in some circumstances, thus adding complexity to establishing the baseline.	Considered in a range of protocols across a range of carbon policy frameworks and markets.
Avoided waste combustion	Organic materials that would otherwise have been combusted, producing carbon dioxide emissions.	Various models exist for predicting the GHG emissions from these sources. Emissions from the combustion of organic materials are considered as a biogenic source of emissions.	Contemplated as a project condition for incineration projects.
Carbon sequestration	Conversion of biomass to biochar sequesters carbon. Incorporation of biochar within the soil matrix can lead to the enhanced sequestration of soil carbon.	Concerns that carbon sequestration within the soil is not permanent are being applied to biochar, where risks are significantly lower. Soil carbon sequestration is difficult to measure.	Considered broadly in forestry and agriculture protocols.
Fertilizer efficiency	Biochar may 1) improve the efficiency of fertilizer usage relative to yield, and 2) alter processes that lead to emissions, resulting in lower N_2O emissions from fertilizers and reduced CH_4 production.	Difficult to measure changes in CH_4 and N_2O emissions at a field scale. Modelling of N_2O can be resource intensive and requires a significant research and field data.	Considered in other agriculture protocols, including a number of fertilizer efficiency protocols under development.
Electricity displacement	Electricity produced from biochar projects may offset electricity produced from fossil fuels.	This is an indirect emission reduction and may not be considered under all programs.	Considered in other projects where there is electricity output, such as landfill gas and energy from biomass combustion projects.
Fossil fuel displacement	The heat, power, and biofuels produced from the biochar projects may offset fossil fuel usage downstream.	This is an indirect emission reduction and may not be considered under all programs. There may be difficulties in direct measurement given the downstream nature of the emission reduction and conversions between equivalent units of energy.	Considered in other projects where there is heat, power, or biofuels being produced, such as landfill gas and energy from biomass combustion projects.

5.4 Baseline Assessment

For each of the emission reduction mechanisms, there is a need to establish a credible baseline condition. The baseline condition is assessed based on the governing principles of the standard being employed (i.e. ISO 14064 pt II). It answers the essential question of what would most probably have happened in the absence of the project. For example, if the feedstock material wasn't converted to biochar, it may otherwise have been disposed of in a landfill.

The assessment of applicable baseline conditions can be done on a project-specific basis or as part of a broader approach, commonly termed performance standards. Under a project-specific baseline, each project must assess and substantiate an appropriate baseline, with guidance provided in the applicable protocol. Under the performance standard approach, a baseline that is broadly applicable across a given geography or within some other boundary is provided for use across all applicable projects. For this initiative, it is envisioned that a project-specific baseline approach will be used.

Further, in establishing a baseline condition, due consideration of the functional equivalence between the project and baseline conditions is required. It ensures that the baseline and project conditions achieve comparable results. Establishing functional equivalence typically is based on a governing metric, such as crop yield or mass of material processed. As an example, the assessment of the functional equivalence of the baseline and project conditions for a biochar project producing a biofuel, where fossil fuel is being displaced, could be made on a "per unit of energy" basis, reflecting the differences in energy potential between equivalent volumes of the biofuel and fossil fuel.

5.5 Additionality and Leakage

Currently, the additionality of projects is assessed differently for each carbon offset system. In Alberta, additionality is addressed programmatically by looking at project start dates, whether the project is surplus to regulation, and by criteria embedded within the protocol documents. As such, each project type has the assessment of additionality tied to the content and availability of the protocol. Each project must then evaluate its compliance with the additionality criteria.

For VCS, the assessment of additionality is substantively more complex. To meet the first step of the additionality test, the project shall be surplus to any enforced law, statute or other regulatory framework. All projects must then demonstrate that they are additional using one of a selection of three additionality tests (as per the VCS Guideline 2007.1). The three tests are;

Test 1 – Project Test.

Test 2 – Performance Test.

Test 3 – Technology Test.

In addition to meeting applicable requirements of the VCS program, Agriculture, Forestry and Other Land Use Projects (AFOLU) projects must also meet all requirements of the applicable current version of Guidance for AFOLU Projects. This document elaborates on the acceptable approaches and requirements to substantiate additionality of AFOLU project types by providing project developers with a greater level of detail and direction in order to meet the criteria from VCS 2007.1.

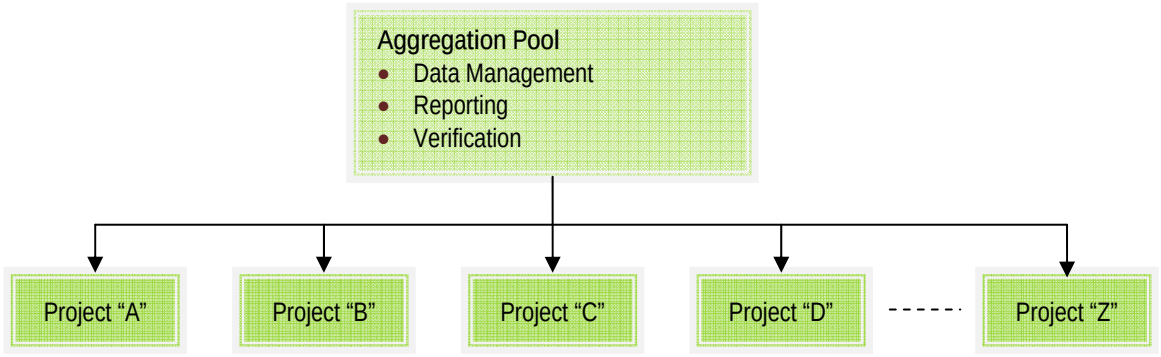
As well as meeting the additionality requirements for VCS and AOS project eligibility, all projects must account for leakage as a part of their analysis. Leakage is defined as any increase in GHG emissions that occurs outside of a projects boundary (but within the same country), but it is measurable and attributable to the project activities. Its effects on all carbon pools must be assessed. By way of example, decreasing fertilizer use may result in decreased yield, thus necessitating more extensive agriculture elsewhere to meet demand. The selection of an appropriate unit of functional equivalence (i.e. per bushel or per kg of beef produced) can provide a means of mitigating this risk.

Leakage is calculated by applying the risk analysis tool to the project, and once completed the results will be required to undergo double validation to ensure accuracy and conservativeness. Depending on the "risk versus significance" outcome of the risk tool analysis, the project will have to surrender a certain percentage of carbon credits to a buffer pool.

5.6 Aggregation

To overcome the economies of scale required for accessing the GHG offset markets, smaller projects may need to be aggregated together. Under an aggregation model, similar projects that may each be expected to yield less than 10,000 tonnes of CO_2E per year in offsets are bundled together as per Figure 3. By pooling the data management, reporting, and verification functions across projects, each of the projects will be able to reduce their net costs. Although the savings are not always directly proportionate, this can mean significant cost savings for each project developer.

Figure 3 Aggregation Model



To support small-scale project development, it is possible to proactively incorporate guidance into the protocol to support achieving these economies of scale through aggregation. This may include streamlined measurement and monitoring for small projects, or the exclusion of certain emission reduction mechanisms that become immaterial (relative to the costs to capture the benefit) once the size of a project drops below a given threshold.

5.7 Measurement and Monitoring

Protocols provide guidance on the measurement and monitoring practices that are appropriate for each key variable required to quantify the emissions and sequestration under both the project and baseline condition. There may be multiple means of completing the measurement and monitoring, in addition to contingent approaches for addressing gaps in data.

For many of the emission reduction mechanisms presented in Table 1, above, there is best-practice guidance for measurement and monitoring. These typically require direct measurement of some parameters and the use of published model parameters and emission factors. However, for both the Soil Carbon Accumulation and Fertilizer Efficiency mechanisms this is not as well understood. Detailed discussion of both of these mechanisms is provided in the science and technical issues primer.

For this protocol development process, measurement and monitoring requirements will be considered from two perspectives: rigour and practicality. The protocol needs to meet the base requirements for rigour in order to support claims for legitimate offset creation. However, the measurement and monitoring practices cannot be prohibitive either in terms of cost or feasibility.

There are a number of mechanisms that may need to be employed where there is a conflict between rigour and practicality. This may include excluding emission reduction mechanisms, where they cannot yet be rigorously quantified but where it is conservative to do so. It may also include discounting offset claims to address any uncertainty in measurement. Employing these mechanisms is typically a last resort and meant to drive further research into the development of improved measurement and monitoring techniques.

6. Proposed Path Forward

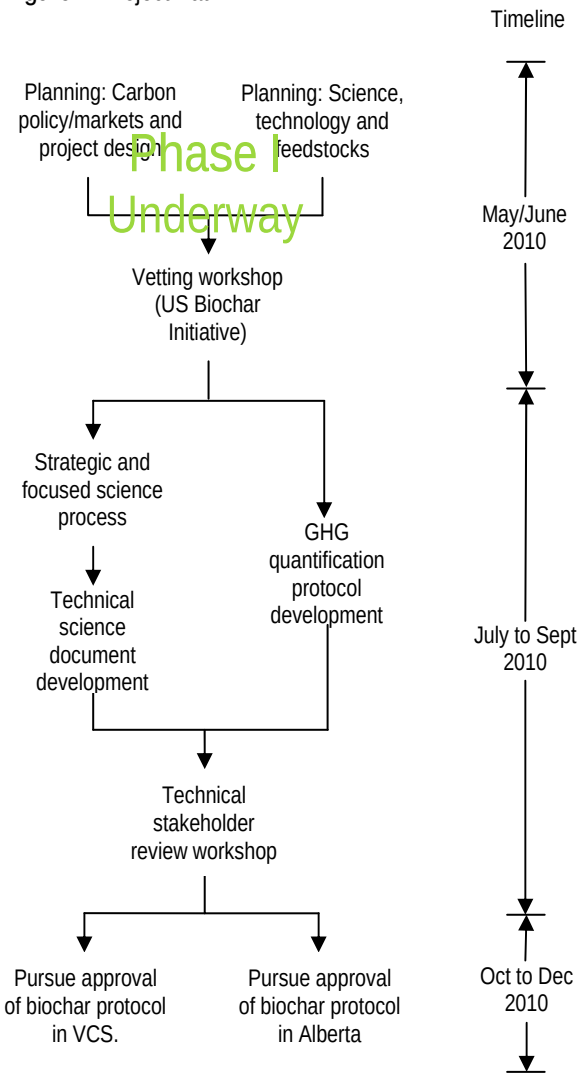
Building from the feedback and engagement with stakeholders in the first phase of the project, the work plan illustrated in Figure 4 has been developed to support the Phase II development of a biochar protocol. Subject to funds being available for its delivery, this work plan will deliver a rigorous and science-based protocol (with supporting documentation) by the end of 2010.

The preliminary results of this work will be presented at the International Biochar Initiative Conference in Rio de Janeiro, September 2010 in order to share this work in the international realm. Further North American stakeholder

engagement sessions will be held through the fall of 2010.

More detail on each element of the work plan and the costs associated with their delivery is provided in the following summary of Phase II work plan elements.

Figure 4 Project Path



Project Support

To support the activities in the work plan for Phase II, the project team is seeking financial contributions totalling between $100,000 and $120,000 from strategic *Sustaining Project Sponsors*. These sponsors will play a leading role in guiding the development of the protocol and ensuring applicability to their project platforms. In-kind support is also being sought broadly from the biochar community to support the review and analysis required for this effort.

For more information on becoming a Sustaining Project Sponsor, please contact us at info@biocharprotocol.org.

Summary of Phase II Work Plan Elements

Technical Science Document Development

- Bring together all the required scientific information into a document suitable for supporting protocol development and review.
- Engage with leaders in biochar and related sciences to validate approach on key issues.
- Communicate results of the technical review to stakeholders to build capacity toward protocol review.

Deliverables: Technical Science Document, with summary slide deck, following requirements for the AOS, supplemented to meet VCS requirements.

Cost Estimate: $15k to $20k depending largely on the scope of project types being considered and the number of any project partners.

GHG Quantification Protocol Development

- Develop generic GHG emission reduction quantification protocol following the ISO 14064 pt II.
- Provide a companion document summarizing the key policy and technical issues, with particular attention to any continuing gaps in science.
- Review the quantification protocol with stakeholders to gain insights on key issues.

Deliverables: ISO 14064 pt II compliant protocol document with companion document linking to Technical Seed Document.

Cost Estimate: $15k to $20k based principally on the scope of project types considered and number of any project partners.

Technical Stakeholder Review Workshop

- Facilitate web-based workshop on key and outstanding science, carbon policy, and quantification issues prior to initiation of the protocol review processes.
- Incorporate feedback from the technical stakeholders into the Technical Science and Protocol documents.

Deliverables: Facilitate workshop and summarize feedback for stakeholder group review. Revise Technical Science and Protocol documents, as required.

Cost Estimate: $5k to $10k per workshop depending on scope of analysis.

Pursue Approval of Biochar Protocol under the Voluntary Carbon Standard

- Submit protocol for review under VCS.
- Support protocol review, including engagement of third-party validators as required and/or participation in review working groups.

Deliverables: Protocol submission, revised as required to support approval. Slide decks, as required through approval process.

Cost Estimate: $60k to $70k including third-party costs associated with the double validation process.

Note: Protocol will be submitted for review in other regimes (CDM, CAR, Cdn. Fed., USDA / US EPA, etc) as may be relevant to the stakeholder group and the results of the work under a separately funded Phase III of the work.

Pursue Approval of Biochar Protocol in Alberta

- Submit protocol for review as part of the AOS protocol review process.
- Support protocol through review process, providing supplemental information as required by regulator.
- Revise documentation (Technical Science and Protocol documents), as per the results of each round of review.

Deliverables: Protocol submission, revised as required to support approval. Slide decks, as required through approval process.

Cost Estimate: $5k to $10k in consideration of the work that will have been completed already.