Case Study: Initial Design Phase of a Web-based Program to Catalyze Investments in Carbon Sequestration

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Disclaimer

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Research performed by Augusta Systems for the United States Department of Energy's (USDOE) National Energy Technology Laboratory (USDOE/NETL) indicates that public and private sector greenhouse gas (GHG) emissions management planners have limited tools to help foster voluntary investments in GHG management activities, including those focused on carbon sequestration.

To meet this end, Augusta Systems assessed opportunities to develop a technology, tentatively called the "Carbon Offset Opportunity Program" (CO-OP), which will provide a platform to catalog carbon sequestration and other related projects seeking investment and serve as a clearinghouse to match potential investors to these contemplated projects. This application would allow government bodies and non-governmental organizations, to assist in catalyzing GHG projects and activities, through carbon sequestration, and in a way that emphasizes voluntary actions by industry. Although West Virginia is serving as an initial test application for this technology, the vision for the project is to apply CO-OP to the benefit of industry, government, and non-governmental organizations throughout the United States.

The emerging focus on GHG management has brought renewed attention to the USDOE Voluntary Reporting of Greenhouse Gases Program. Commonly referred to as the 1605(b) program, which is its citation in the Energy Policy Act of 1992, it is a national voluntary reporting system and database on GHG emissions and emissions reduction activities. To aid CO-OP users in meeting 1605(b) guidelines, CO-OP will be designed to support the 1605(b) program registry requirements and be flexible to evolve as the program changes.

Augusta Systems conducted a domain requirements analysis for CO-OP, in consultation with West Virginia government entities and businesses, to establish the data sets and elements that must be present for CO-OP to yield tangible results for government policy makers and industry decision makers. These consultations included both interviews and concept reviews with representatives of government entities, energy businesses, and other enterprises. Relying on the domain requirements analysis, Augusta Systems also conducted a technical requirements analysis to establish the computing technologies and applications that would be best suited for the development of CO-OP. Then, Augusta Systems utilized the results of this research to prepare the final requirements analysis for CO-OP.

This report focuses on the initial requirements analysis necessary to begin the design of the CO-OP technology. In undertaking this effort, it is anticipated that subsequent phases may be initiated to promote the actual development of the CO-OP technology. This initial requirements analysis report features research on analogous programs, research on possible requirements resulting from the structure of the USDOE 1605(b) program, research on possible requirements based upon interviews with potential CO-OP stakeholders, analysis of requirements research, research and analysis of technical requirements, and presentation of conclusions.

1.0 INTRODUCTION

In October 2002, the United States Department of Energy (USDOE) National Energy Technology Laboratory (USDOE/NETL) issued a task to Augusta Systems. The purpose of this project was to assess the present state of technology regarding greenhouse gas (GHG) emissions management strategic planning tools for public policy planning and industrial strategic planning, and to formulate a plan to advance research and development of these tools, with an application focus on the State of West Virginia.

This project was initiated as USDOE/NETL has identified that international, national, and local measures are being assessed and implemented that could aid in the reduction and concentration of GHG and, most significantly, carbon emissions. To date, a universally acceptable approach for framing policy and market measures has not developed. As a result, public policy makers and corporate decision makers are left without a clear method with which to approach the options for GHG emissions management, including, most significantly, project-based applications and market trades involving terrestrial and geologic carbon sequestration applications.

The results of the initial research activity indicated that these public and private planners have access to a small number of tools with limited functionality with which to perform their quest for seeking best options for GHG emissions management policy and business strategies. Thus, a need was identified for technology advancements and innovations focused on producing additional tools for states, other governmental subdivisions, and non-governmental organizations to utilize in GHG emissions management planning, especially regarding the initiation of carbon sequestration investment opportunities.

To meet this end, a technology concept, tentatively called the “Carbon Offset Opportunity Program” (CO-OP) was outlined that could provide a platform to catalog carbon sequestration and other related projects seeking investment and serve as a clearinghouse to match potential investors to these contemplated projects. In theory, entities with significant GHG emissions, which are seeking GHG emissions reduction or offset credits, would be interested in investing in these activities in an effort to secure emissions credits. The CO-OP technology should be designed in accordance with the USDOE Voluntary Reporting of Greenhouse Gases Program, more commonly referred to as the 1605(b) program, registry requirements and invoke a flexible architecture that will allow the tool to evolve as the 1605(b) program undergoes changes and amendments.

Principally, the CO-OP technology, with its opportunity to catalog the potential sequestration projects available for investment and serve as a clearinghouse to match potential investors to these contemplated projects, would allow state and local governments, and potentially non-governmental organizations, to assist in catalyzing GHG emissions reduction activities, through carbon sequestration, and in a way that emphasizes voluntary actions by industry. With West Virginia serving as an initial test application for this technology, CO-OP could be applied to the benefit of other state governments, local governments, industry, and non-governmental organizations. As this technology and catalyst takes on a more dynamic role and more GHG emissions reduction activities are initiated, CO-OP technology could be further enhanced.

Augusta Systems performed a requirements analysis for CO-OP which included conducting, in consultation with West Virginia government entities and businesses, a domain requirements analysis to establish the data sets and elements that must be present for CO-OP to yield tangible results for government policy makers and industry decision makers. These consultations included both interviews and concept reviews with representatives of government entities, energy businesses, and other enterprises. Relying on the domain requirements analysis, Augusta Systems also conducted a technical requirements analysis to establish the computing technologies and applications that would be best suited for the development of CO-OP. Then, Augusta Systems utilized the results of this research to prepare the final requirements analysis for CO-OP.

This report focuses on the initial requirements analysis necessary to begin the design of the CO-OP technology. In undertaking this effort, it is anticipated that subsequent phases may be initiated to promote the actual development of the CO-OP technology. This initial requirements analysis report features research on analogous programs, research on possible requirements resulting from the structure of the USDOE 1605(b) program, research on possible requirements based upon interviews with potential CO-OP stakeholders, analysis of requirements research, research and analysis of technical requirements, and presentation of conclusions.

2.0 ANALAGOUS PROGRAMS

From prior research, it was identified that no tool or portal allowed for a platform to catalog domestic United States carbon sequestration and other related projects seeking investment and serve as a clearinghouse to match potential investors to these contemplated projects. The initial requirements analysis began with research into environmental commodity catalogs that could be assessed for similarities to the contemplated program, as well as regarding foreign platforms or international standards presently in place that might highlight informational or functional needs of CO-OP.

2.1 Environmental Commodity Catalogs

An investigation of analogous tools and portals for environmental commodities identified similar cataloging and clearinghouse tools for brownfields, plastics recycling, and forest management. These tools and portals provide testimony to the value of web-based catalogs for environmental commodity projects and suggest that CO-OP would likely be valued by potential sequestration buyers, sellers, and investors as it would perform a similar function for carbon sequestration and other related GHG management projects. Information on this research follows.

2.1.1 Brownfields

The Pennsylvania Site Finder (PA Site Finder, http://www.pasitefinder.state.pa.us), an initiative of the Pennsylvania Department of Environmental Protection's Land Recycling Program, provides a domain for purchasers and suppliers of brownfield properties. Through PA Site Finder's on-line catalog of brownfield properties, users can search available properties and the technology that powers the platform will produce results that match the specified search criteria. Each property listed on PA Site Finder is documented with information on location, size, price, and other factors.

Developed in 1995, the Land Recycling Program of Pennsylvania has been acknowledged with the Innovations in American Government Award by the Ford Foundation and Harvard University for its successes in matching parties interested in brownfields redevelopment.

2.1.2 Plastics Recycling

GreenOnline™ (http://www.greenonline.com) is a technology and portal owned by the Polymer Alliance Zone of West Virginia (PAZ), which provides web-based trading and interaction software for environmental markets. The technology has been structured in a manner that allows interested parties to organize markets around environmentally-based goods using the GreenOnline™ technology. PAZ is presently in the process of launching an application focused on the plastics recycling marketplace, which would, in theory, provide a similar marketplace to that which the Chicago Climate Exchange™ hopes to provide for GHG emissions commodities.

This GreenOnline™ platform contains numerous market-making features, which include functions that allow users to request proposals and quotes for, under the current iteration, plastics recycling commodities.

2.1.3 Forest Management

Forestland MLS (http://www.forestlandmls.com) is an on-line property information and listing service, which features property tracts primarily in the southeastern United States. A recent examination of the service located tracts in a number of states, including Kentucky, South Carolina, Tennessee, Virginia, and West Virginia.

These properties are listed by general categories that include properties available for investment, forest management, as well as residential, recreational, commercial, and industrial development. Users of this service can access property listings by general category, specific use, location, acreage quantity, and price data. In addition to the information regarding the property, the service provides data on the owner and/or broker of the property in order to facilitate direct communication.

Potential uses of Forestland MLS include obtaining information on properties appropriate for wetland banking and, potentially, managed timbering.

2.2 GHG Platforms

As noted, the research also included an investigation of foreign platforms or international standards presently in place that might highlight informational or functionality needs of CO-OP. From the research, one foreign platform and one international standard emerged that could provide useful information related to the design and function of CO-OP – Canada's Greenhouse Gas Emission Reduction Trading Pilot (GERT Pilot) and the World Business Council for Sustainable Development (WBCSD) / World Resources Institute (WRI) Greenhouse Gas Protocol (GHG Protocol). Details on these resources and their relevance to CO-OP follow. Additionally, the Intergovernmental Panel on Climate Change (IPCC) is developing a special report on carbon dioxide capture and storage, which is expected to be available in 2005. Once completed, this report could impact future versions of CO-OP.

2.2.1 Greenhouse Gas Emission Reduction Trading Pilot

GERT Pilot is the Canadian federal government-initiated GHG trading and project review platform. This program was forged as an alliance between the Canadian federal government, six Canadian province governments, industry associations, and environmental groups. Notable participants in GERT involved via their industry associations and various project activities include B.C. Hydro, CHI Energy, Ontario Hydro, and SaskPower, among others.

As part of its mission, GERT includes opportunities for interested parties to post opportunities to buy, sell, and trade GHG emissions reduction and offset opportunities. Offers to buy or sell on GERT include information on entity contacts and project characteristics. Specifically, the entity contacts section of GERT filings includes data on entity name, entity contacts, and entity sector, while the project characteristics section features data on locations, types, GHG emissions reduction volumes, GHG emissions reduction unit price ranges, and supporting data.

Of all analogous programs assessed, GERT is likely the portal with the greatest potential contribution to the design and functionality of CO-OP. However, due to the limited number of applications filed to date, the platform does not appear to have functionality

for searches of applications by various criteria, so it cannot be said to provide guidance on all matters related to CO-OP.

2.2.2 Greenhouse Gas Protocol

The GHG Protocol, a collaborative endeavor of international public and private sector stakeholders and jointly led by the WBCSD and the WRI, is focused on the development of internationally accepted GHG accounting and reporting standards. Through the efforts of the involved parties, the endeavor produced a possible standard for international GHG accounting and reporting.

While the most significant portion of the GHG Protocol focuses on corporate practices with regard to GHG emissions tracking and accounting, some sections of the document provide guidance on information that may be useful to include in a filing on a carbon sequestration or another GHG emissions reduction or offset project in CO-OP since the design of CO-OP is intended to complement current and future inventory reporting processes. For a report on GHG emissions, the GHG Protocol urges the inclusion of the following:

- Information on the organization and boundaries of filing (including organizational name and boundaries, reporting period, and inclusion/exclusion of specific sources);
- Information on emissions and performance (including emissions volume data, emissions covered, and emissions by subunits of above-referenced organization); and,
- Supporting information (including emissions calculation methodologies).

Based upon the sections of the document covering what entities should report regarding GHG emissions, it appears that the most significant data an entity might wish to include in reporting a GHG emissions reduction activity would incorporate information clustered around three areas – organizational information, carbon sequestration or other emissions reduction or offset activity data, and supporting information.

3.0 1605(b) PROGRAM

To aid CO-OP users in meeting guidelines from the USDOE's Voluntary Reporting of Greenhouse Gases program, the 1605(b) program, CO-OP will be designed to support the 1605(b) program registry requirements and be flexible to evolve as the program changes. Research on the 1605(b) program has detailed the present requirements for reporting of GHG emissions reduction and offset project investments and outlined suggestions from 1605(b) stakeholders for future amendments to the emissions reduction and offset project reporting standards.

3.1 1605(b) Overview

Under Section 1605(b) of the 1992 Energy Policy Act, the United States Congress established the Voluntary Reporting of Greenhouse Gases Program in order to meet United States commitments under the United Nations Framework Convention on Climate Change (UNFCCC). The program serves as a mechanism for entities that have voluntarily reduced their emission levels to record their achievements, as well as communicate their ideas of action with other stakeholders in the hopes of stimulating future GHG emissions reduction efforts. The 1605(b) program is administered by the Energy Information Administration (EIA), which maintains a public database and publishes annual reports on voluntary GHG reporting.

The voluntary reporting system supports achievements in GHG emissions reductions. Both terrestrial and geologic carbon sequestration projects can be reported via the 1605(b) program. In fact, nearly 500 carbon sequestration projects were reported in 2000. For example, in 2000, Allegheny Energy reported its efforts regarding the Western Oregon Carbon Sequestration Project. Terrestrial carbon sequestration is recognized as an official mechanism for reducing carbon dioxide emissions. Thus, some domestic informational standards exist for voluntary reporting of emissions. However, well-developed guidelines do not exist for reporting of geologic carbon sequestration activities. Under the current structure, projects that incorporate "underground injection of carbon dioxide" are categorized under the "other emission reduction projects" category, which do not benefit from detailed, structured guidelines. Therefore, while the 1605(b) would be helpful in structuring the informational and functional formatting of CO-OP, the present structure of the program fails to provide sufficient guidance in a key area of future growth – geologic sequestration. It is anticipated that revised geologic sequestration informational guidelines, though, may emerge from a revised 1605(b) program.

3.2 Potential 1605(b) Program Enhancements

In February 2002, the Bush Administration announced that an interagency working group, composed of representatives from USDOE, the United States Department of Agriculture (USDA), and the United States Environmental Protection Agency (USEPA), had been charged to review the existing 1605(b) program and make recommendations on enhancements to position the United States to achieve the Global Climate Change Initiative's GHG intensity goal of an 18 percent reduction over the next 10 years. The interagency working group has been involved in numerous outreach efforts including soliciting input from GHG stakeholders by facilitating a series of interactive workshops and requesting public comments on suggested enhancements to the existing program.

In July 2002, the Secretaries and Administrators representing the member agencies of the interagency working group, along with the Secretary of Commerce, submitted 1605(b) program enhancement recommendations to the Bush Administration. These recommendations emerged under the unsuccessful Energy Policy Act of 2002 legislation, embodied in Senate bill S.517 and House of Representatives bill, H.R. 4611.

Throughout the development of S.517 and H.R. 4611, a majority of the public stakeholders remained steadfast in supporting the inclusion of four main 1605(b) enhancements within the legislative language of the new guidelines to be determined by the proposed Energy Policy Act of 2003, which are:

(1) Support of mandatory entity-wide reporting;
(2) Guarantee of baseline protection and credit for past GHG reduction actions (including carbon sequestration);
(3) Establishment of verifiable and transferable (both nationally and internationally) GHG emissions reduction credits through the development of standardized accounting practices; and,
(4) Formation of industry specific reporting rules and calculation protocols.

Most recent comments discerned from the 2002 workshops posed concerns from stakeholders as to the capabilities of the executive branch to have the legal authority to "guarantee" credit for past GHG reduction efforts. Further commentary was expressed by the International Climate Change Partnership (ICCP) in support of utilizing the GHG Protocol as a benchmark for developing the corporate accounting and reporting standards for the enhanced 1605(b) guidelines. Additional comments were made by the American Petroleum Institute (API), among others, to include geologic sequestration as an additional carbon storage option within the context of the new guidelines.

3.3 Terrestrial Sequestration Reporting Under the 1605(b) Program

The voluntary GHG registry reporting information of particular interest to research efforts targeting the development of CO-OP, are the project-specific reporting efforts under the category of carbon sequestration, which, as noted, is presently limited in application for geologic carbon sequestration projects. To develop requirements for CO-OP, it is important to consider the information required for terrestrial sequestration reporting by the 1605(b) program.

The structure of the EIA-1605 reporting form consists of four schedules or sections, including: Schedule I, Entity Information and Certification; Schedule II, Project-Level Emissions and Reductions; Schedule III, Entity-Level Emissions and Reductions; and, Schedule IV, Commitments to Reduce Greenhouse Gas. For the purpose of this report, focus has been placed on the specific actions which entities have taken to reduce emissions contained within Schedule II, Project-Level Emissions and Reductions, Section 8, Carbon Sequestration. However, since CO-OP would involve entry of organizational data, an explanation of data submission under Schedule I, which contains similar information in the 1605(b) program, is also provided.

Within Section 8 of Schedule II, the reporter must submit data corresponding to the carbon sequestration project in four distinct parts, including: Part I, General Information; Part II, Specific Information; and, Part III, Emissions/Reductions; and Part IV, Project Evaluation. Reporters must submit detailed project information, such as estimation

methods and reference case projects to support their carbon and carbon dioxide reduction claims associated with terrestrial sequestration efforts. The following sections will outline the data submission process for Schedule I and II of the 1605(b) program.

3.4 1605(b) Program Data Submission Process

Information pertaining to the voluntary entity or project reporting can be entered and viewed by third parties through the EIA-1605 Electronic Data System. This section will introduce the detail of data entry with the aid of actual entry windows to exemplify data entry for an example entity, AES Hawaii, Inc.

Data entry can be performed by three methods – radio buttons, selectable pull down menus, and text field entries – that are paired with allowable character default values. The corresponding text boxes surrounding the entry windows provide detail as to the data entry method of particular requirements. In the following screenshots, abbreviations are utilized as follows: radio buttons (RB); selectable pull down menus (PD); text field entries (FE); and, character default values (Char.).

3.4.1 Schedule I – Entity Information and Certification

Schedule I data entry is primarily composed of entity identification and contact information, in addition to certification information and reporting project location. Aside from providing general contact information (names, titles, addresses, telephone numbers, and facsimile numbers), more detailed information is requested of the reporter in terms of entity type (individual or family, partnership, corporation, limited liability company, government, joint venture, trade association, or other), entity Standard Industrial Codes (SIC), and an entity description which may include a descriptive text field entry or a selection from a descriptive pull down menu (publicly traded, privately traded, non-profit, or subsidiary). If an entity wishes to enter any confidential information or supplemental text, text field entries with unlimited character default values are provided. Figure 1 illustrates the data entry window associated with Schedule I.

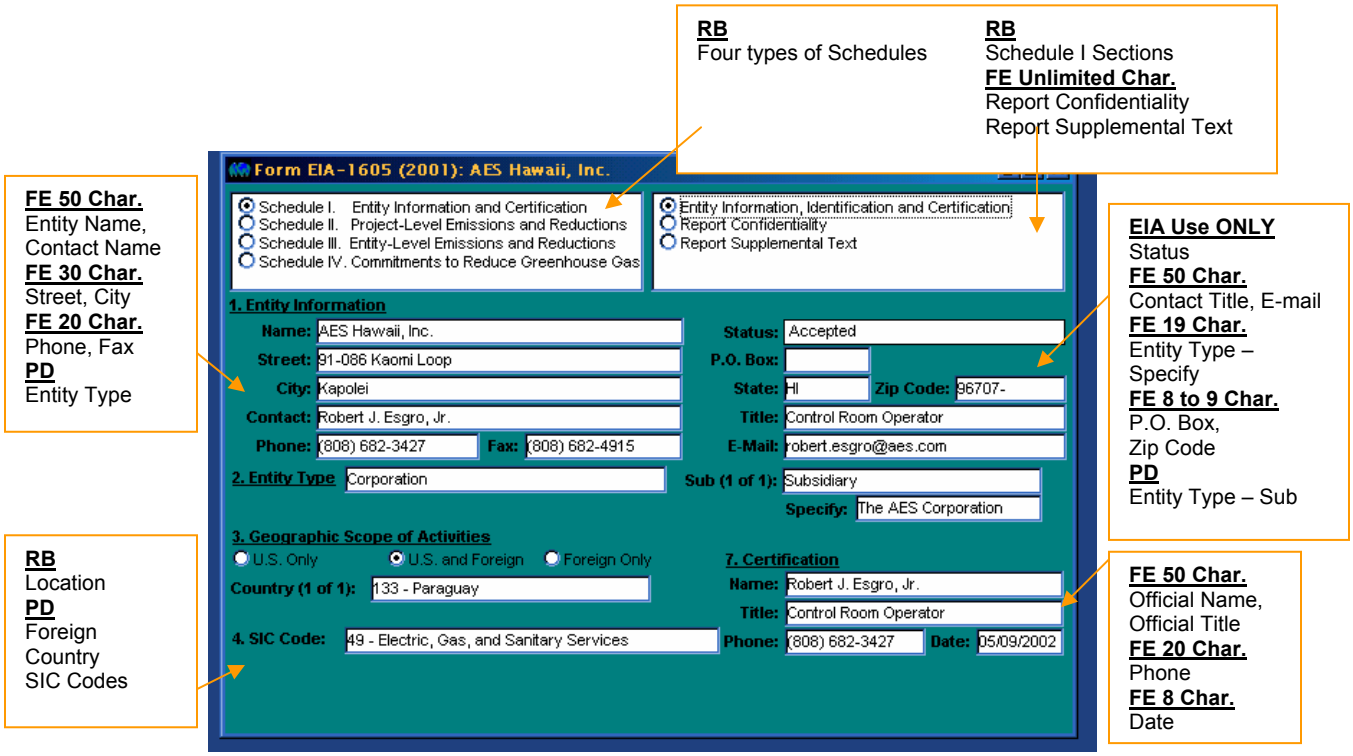

Figure 1. Schedule I, Entity Information and Certification, Main Window.

3.4.2 Schedule II – Project-Level Emissions and Reductions

Schedule II, Project-Level Emissions and Reductions, allows an entity to report on specific projects classified under the ten project sections identified in Figure 2 below. The project section of interest is Section 8, Carbon Sequestration. Detailed information entered within Schedule II includes general project information (name of entity, name and location of project, etc.), as well as specific information concerning project characteristics, emissions reductions and sequestration quantities, and estimation methods. Figures 2 and 3 illustrate the preliminary steps associated with reporting a project.

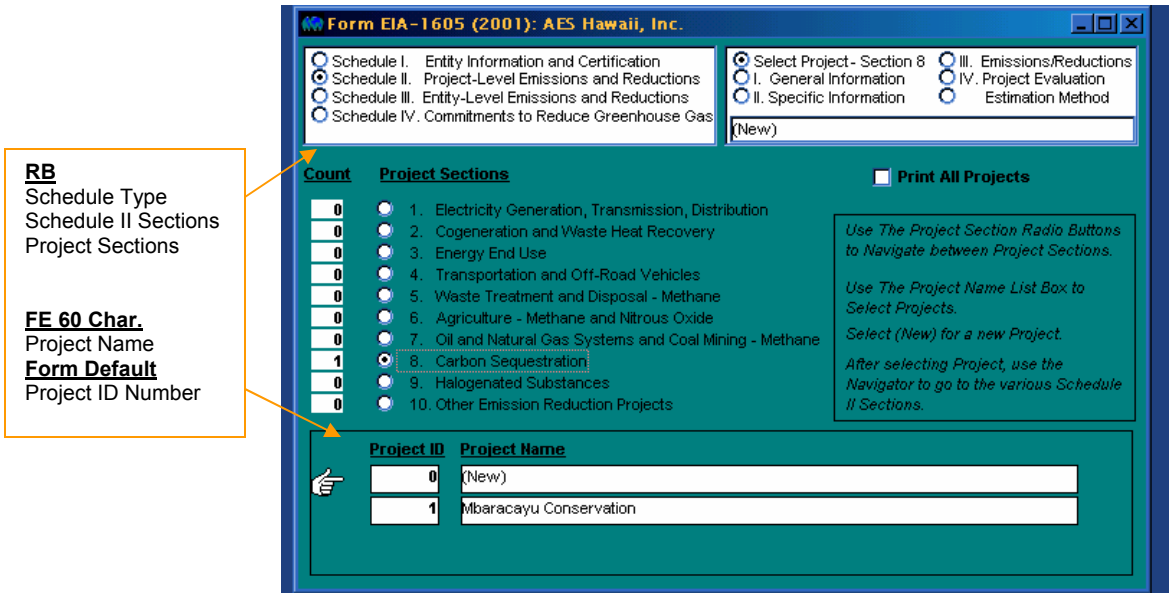

Figure 2. Schedule II, Project-Level Emissions and Reductions Window.

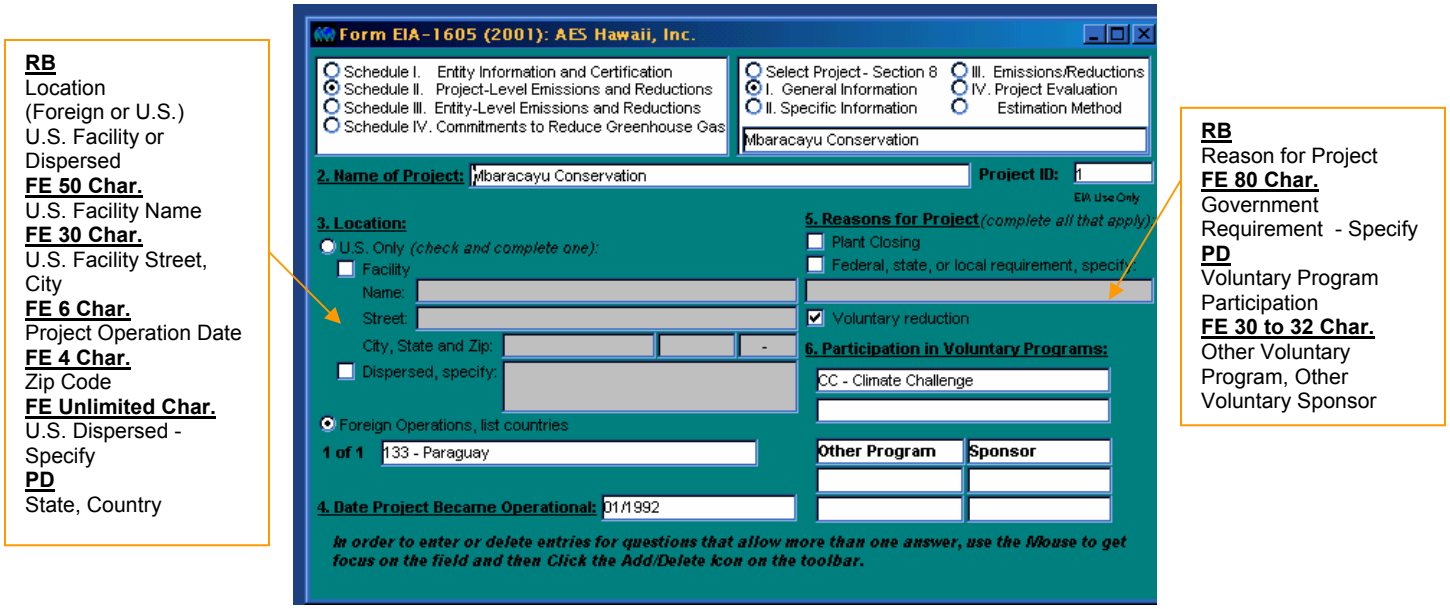

Figure 3. Schedule II, General Information Window.

General information concerning the entity's participation with other voluntary programs, as well as the motivation behind conducting the project (plant closing, government requirement, or voluntary reduction) is also included in Schedule II, as depicted in Figure 3.

The specific information section within Schedule II requires the inclusion of data detailing the type of terrestrial carbon sequestration project, as well as information about the land use, which is shown in Figure 4. The types of terrestrial sequestration projects and

definitions are represented in Appendix A. For consistency, the same project types and corresponding definitions will be used in CO-OP. The forest composition type has a default description of "forest composition of the activity." However, the reporter can enter specific information corresponding to the species of tree(s). The historic land use describes the functionality and type of forest contained on the land prior to the operation of the project, while the reference case land use corresponds to the functionality of the land had the project not occurred. For example, if a project of planting trees is not performed, then the default land use would be "farming," which leads to a reference case land use of "cropland".

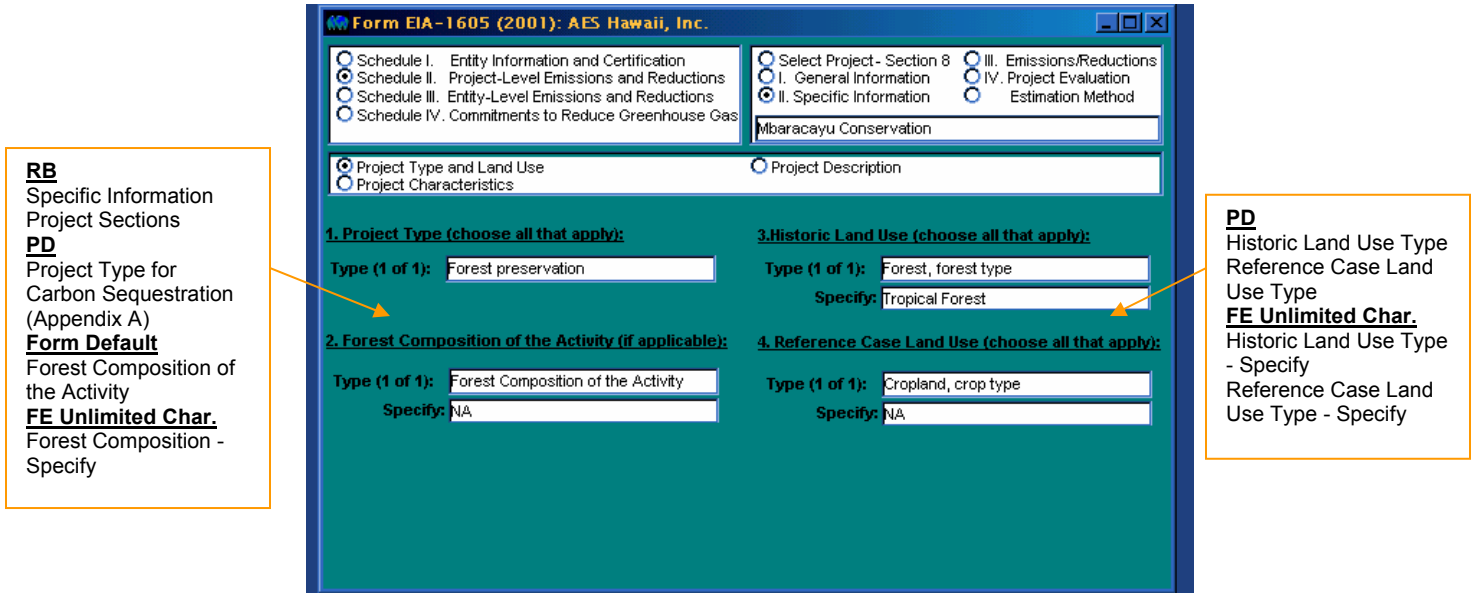

Figure 4. Schedule II, Specific Information Window.

The project characteristics section of Schedule II allows the reporter to enter detailed information corresponding to the applicable default characteristic measures of average number of trees planted per unit area, increase in timber productivity in cubic feet volume growth, area affected, planned harvest age, and mean age of trees, or stands. This is illustrated in Figure 5. Annual quantities of the applicable project measures should be entered in the field entry under the appropriate year, ranging from 1991 to the most recent reporting year. The project description section of Schedule II should include information explaining the basic characteristics of the project and the manner in which the carbon is sequestered, or emissions are reduced. An unlimited character field entry space is provided for this data.

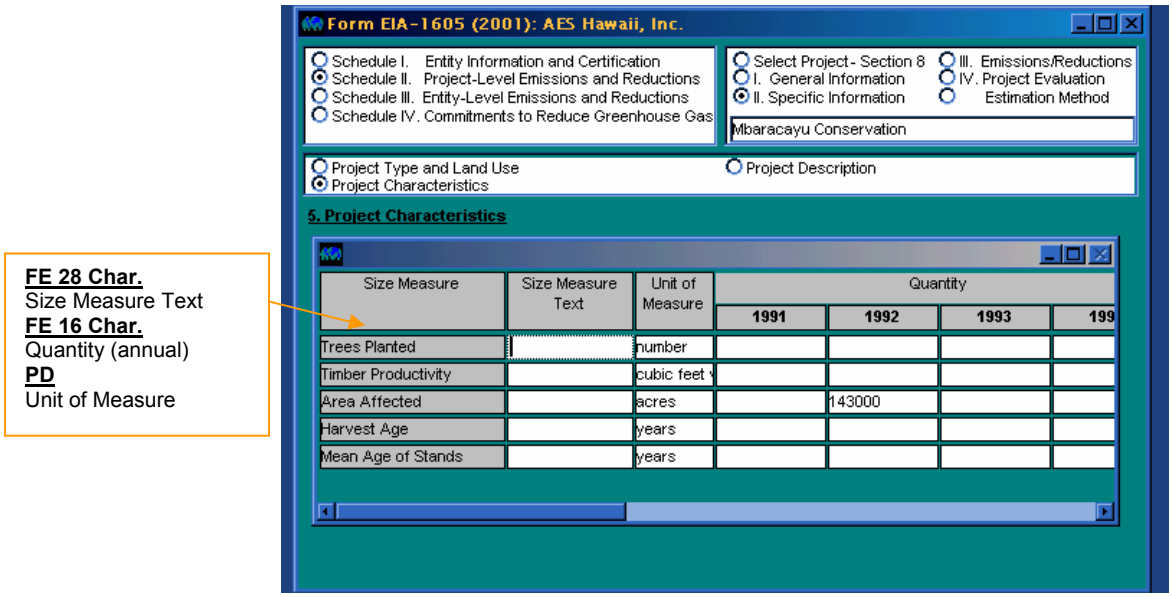

Figure 5. Schedule II, Project Characteristics Window.

Two tables with identical table entry values are supplied within the Emissions/Reductions section of Schedule II for reporters to input data corresponding to individualized project performance, as depicted in Figure 6. The reporter is required to select the table appropriate to the specific project for which they are reporting. The substance refers to the GHG type. There are two choices for the type of measurement, total storage and annual increase. The accuracy of the estimated emissions reductions or storage can be paired with an accuracy value of High (+/- 10 percent error), Moderate (+/- 10 percent error to +/- 50 percent error), and Not Determined (accuracy cannot be estimated). The long-term benefits associated with the project can be represented with annual average emissions reduction values and number of forecasted years, each of which can be entered in a text field. The physical quantities of emissions reduction or storage that occur each year from 1991 to the most recent reporting date can also be documented within a text field beneath the corresponding year.

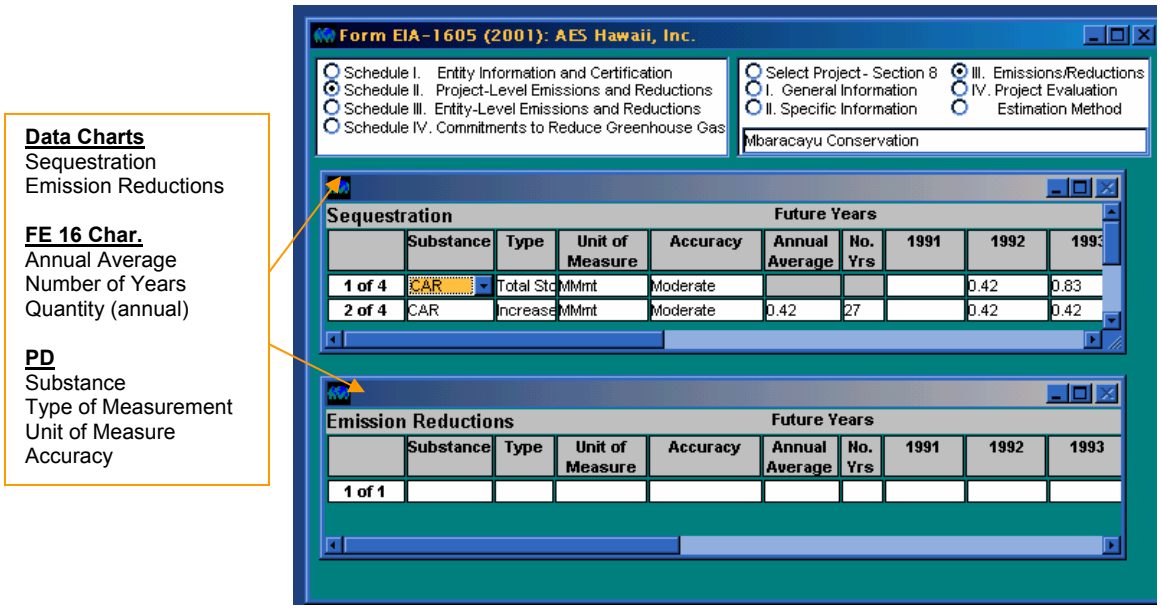

Figure 6. Schedule II, Emissions/Reductions Window.

The Project Evaluation section of Schedule II prompts the reporter for information pertaining to duplicate reporting of project information to various government agencies or other voluntary programs, as well as the reference cases, or assessment of carbon flows prior to the implementation of the project, associated with the estimation methods, as illustrated in Figure 7. The comparison of the reference case to the project emissions reduction or sequestration levels is analogous to a "before and after" assessment (i.e. the carbon flow reduction is equal to the carbon flow for the reference case minus the carbon flow for the project).

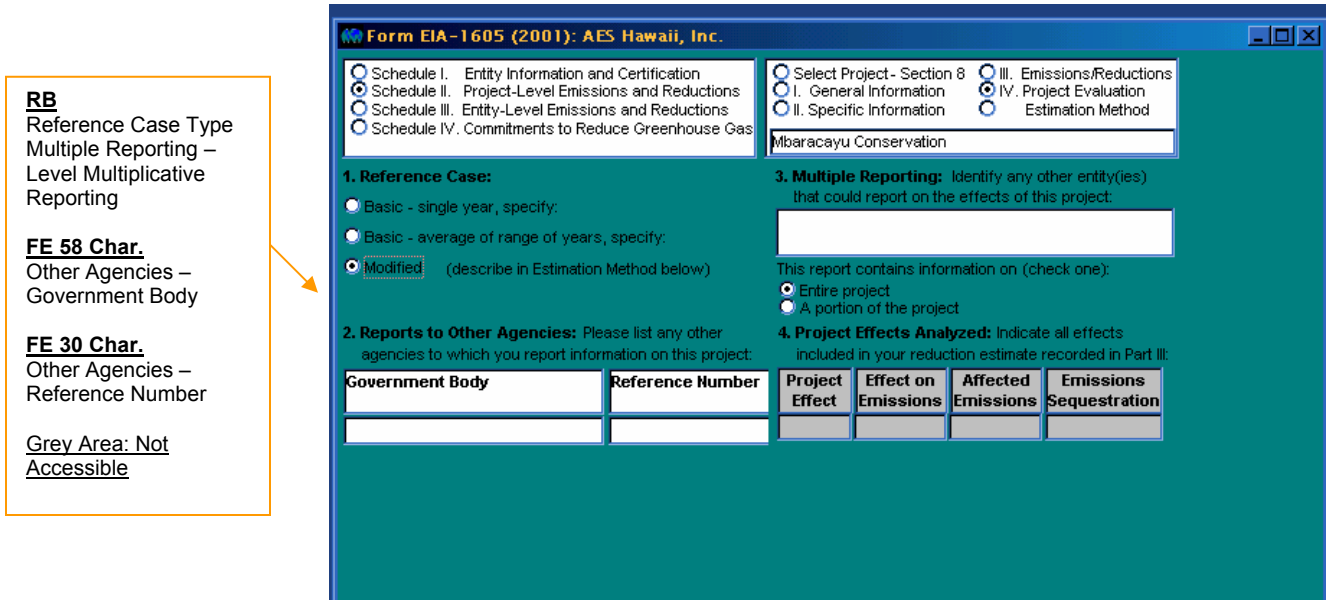

Figure 7. Schedule II, Project Evaluation Window.

The reporter is given two options for the reference case – *modified* (defined as the estimate or sequestration level by the reporter that would have occurred in the absence of the project), or *basic* (defined as the historical emissions or sequestration value associated with a specified period of time, normally annually or a range of years). If no reference case is developed, a reporter would select the *modified* radio button for this section. Examples of sample reference cases drawn from the catalog of 1605(b) terrestrial sequestration projects are represented below:

- Forest preservation project – preserved forest land would have been changed from traditional timber to intensive agricultural land;
- Urban forestry project – prior to implementation of tree planting at owned facilities, the land-use was primarily grassland; and,
- Modified forest management projects – reference case determined from taking carbon flux field measurements of a tropical forest during conventional logging practices, and comparing carbon flux values to those obtained by reduced impact logging practices.

As noted, this section also calls for the disclosure of other governmental agencies or reporting programs that received emissions reduction or sequestration reporting data for the same project reported within the 1605(b) program. An example of a dual governmental reporting agency is the United States Initiative on Joint Implementation (USIJI), which was derived from the efforts of the UNFCCC in order to promote implementation of non-regulatory GHG reduction and sequestration programs/projects overseas. Examples of dual reporting entities identified by reporters to the 1605(b) program include: the Nature Conservancy; the utility terrestrial sequestration consortium called the UtiliTree Carbon Company; and, any civic groups assisting with project efforts.

Reporters can include a description of the procedure(s) used to develop the emissions reduction or sequestration estimations. The estimation method reporting section should contain the following information set forth in the Schedule II reporting instructions:

- Description of the types of data sources (e.g. measurements or estimates);
- Identification of calculation equations, emissions factors, etc.;
- Description of the development of the reference case;
- Identification of the method used to allocate emission reductions between the direct and indirect categories;
- Description of the scope of the emissions reduction or sequestration estimate (e.g. indicate whether upstream or downstream effects are considered); and,
- Identification of other key assumptions such as demand growth, population growth, available technology, tree species composition, etc.

Thus, research on 1605(b) program reporting of GHG emissions reduction and offset project investments was applicable to conducting the domain requirements analysis for CO-OP.

4.0 POTENTIAL STAKEHOLDER INTERVIEWS

In order to best assess the requirements necessary to make CO-OP beneficial to potential users, interviews were conducted with potential stakeholders in West Virginia, which will be the pilot area for the contemplated initial version of CO-OP. A list of 31 potential stakeholder groups was developed, including entities in the energy and mining industries, industry interest sector, public interest sector, government sector, and professional services provider sector. From this initial list, Augusta Systems conducted 15 interviews with representatives of the stakeholders to ascertain sentiments on CO-OP and its requirements.

The following table details the stakeholders with whom interviews were conducted.

Table 1. CO-OP Stakeholder Interviews Conducted March – April 2003.

Organization
Industry
Allegheny Energy
American Electric Power
CONSOL Energy
Industry Interest Sector
Energy Village
Morgantown Chamber of Commerce
West Virginia Coal Association
Public Interest Sector
The Conservation Fund
West Virginia Highlands Conservancy
West Virginia Interfaith Climate Change Campaign
West Virginia Natural Capital Investment Fund
Government Sector
West Virginia Department of Environmental Protection
West Virginia Development Office
Professional Service Provider Sector
Bowles Rice McDavid Graff & Love, PLLC
Spilman Thomas & Battle, PLLC
Jackson Kelly, PLLC

The following section provides brief descriptions of the organizations interviewed.

Industry

Allegheny Energy
Headquartered in Hagerstown, Maryland, Allegheny Energy is an integrated energy company incorporated in 1925. Allegheny Energy has two subsidiary companies – Allegheny Energy Supply Company, LLC and Allegheny Power. Allegheny Energy Supply Company, LLC, a non-regulated energy company formed in 1999, owns and operates electric generating facilities and supplies energy and energy-related commodities to domestic retail and wholesale markets. Allegheny Power delivers

electric and natural gas service to residents of Maryland, Ohio, Pennsylvania, Virginia, and West Virginia.

American Electric Power
Based in Columbus, Ohio, American Electric Power (AEP) is the largest electricity generator in the United States, owning and operating more than 42,000 megawatts of generating capacity in the United States and international markets. Additionally, with nearly 5 million customers, AEP is also one of the largest electric utilities in the United States and features West Virginia as one of its domestic markets.

CONSOL Energy
CONSOL Energy began operations in 1864 and today is the largest exporter of coal in the United States. Currently, CONSOL Energy has 22 mining complexes in the United States, including locations in West Virginia, and has nearly 7,000 employees. CONSOL Energy is the national leader in underground coal mining and mines more high-Btu bituminous coal than any other producer in the United States.

Industry Interest Groups

Energy Village
Energy Village, a nonprofit network based in Morgantown, seeks to coordinate key stakeholders and place West Virginia at the forefront of the global energy technology revolution through the development of an energy and environmental technology cluster of research, businesses, and support mechanisms – an “Energy Village.”

Morgantown Chamber of Commerce
The Morgantown Area Chamber of Commerce is an organization with a focus on community development. In order to accomplish this mission, the Chamber has developed four areas of concentration including: business enhancement; educational pursuits; government relationships; and, human resources.

West Virginia Coal Association
The West Virginia Coal Association is a coal industry trade association based in Charleston, West Virginia. The purpose of the organization is to express a unified voice representing the state's coal industry as well as increase the emphasis on coal as a reliable energy source to help the nation achieve energy independence. The West Virginia Coal Association represents more than 90 percent of West Virginia’s underground and surface coal mine production.

Public Interest Groups

The Conservation Fund
Founded in 1985, the Conservation Fund is a private, non-profit organization dedicated to the conservation of the nation’s land and water resources based in Arlington, Virginia. The Conservation Fund focuses conservation activities in three areas – land acquisition, sustainable programs, and leadership training. As part of its efforts, to date, the Conservation Fund has been involved in a number of terrestrial sequestration projects.

West Virginia Highlands Conservancy
Formed in 1967, the West Virginia Highlands Conservancy (WVHC) is the oldest environmental advocacy organization in West Virginia. Its purpose is to preserve the

natural beauty of the West Virginia Highlands. WVHC is currently involved with a number of issues, including fostering debate regarding wind energy facilities coming to the Highlands and working to ensure preservation of the Blackwater Canyon.

West Virginia Interfaith Climate Change Campaign
The West Virginia Interfaith Climate Change Campaign is one of eighteen similar organizations across the United States that has formed to educate and advocate on the issue of global warming. The organizations are comprised of religious individuals from all faith communities. The interfaith coalitions are supported by the Eco-Justice Working Group of the National Council of the Churches of Christ in the USA, the Coalition on the Environment and Jewish Life, and the National Religious Partnership for the Environment.

West Virginia Natural Capital Investment Fund
Based in Shepherdstown, West Virginia, the West Virginia Natural Capital Investment Fund (NCIF) is a non-profit certified Community Development Financial Institution that provides financing for natural resource-based businesses focused on advancing sustainable economic development throughout West Virginia. Support for the fund has been provided by the West Virginia Development Office, Appalachian Regional Commission, the United States Department of Housing and Urban Development, The Claude Worthington Benedum Foundation, and the United States Treasury's Community Development Financial Institutions Fund. NCIF was launched by The Conservation Fund in 2000 and is associated with The Freshwater Institute, another program of The Conservation Fund founded in 1987 concentrating on the creation of sustainable, environmentally responsible solutions to water resource management.

Government Entities

West Virginia Department of Environmental Protection, Office of Innovation
Created in April 2001, the Office of Innovation is the newest addition to the West Virginia Department of Environmental Protection. The mission of the Office of Innovation is to apply human, financial, technical, and natural resources to build a sustainable environment, economy, and society for West Virginia and forge the creation of new programs within the West Virginia Department of Environmental Protection.

West Virginia Development Office
The West Virginia Development Office (WVDO), the state's economic development agency, serves as a one-stop shop for business assistance, business recruitment, workforce development and community development. As a clearinghouse and assistance organization, the WVDO can provide direct benefit to businesses through hands-on support with matters ranging from financial assistance to trade development.

Professional Service Providers

Bowles Rice McDavid Graff & Love, PLLC
Founded in 1920, Bowles Rice McDavid Graff & Love, PLLC, is a West Virginia-based law firm committed to providing high-quality, effective, and efficient legal services. Today, the firm has a regional presence with six offices and nearly 100 attorneys. The firm represents individuals, professionals, organizations, small businesses, and Fortune 500 companies throughout West Virginia, Kentucky, Virginia and the surrounding region.

The firm has a broad range of practice areas including: energy, environmental, public finance, government relations, taxation, and intellectual property.

Spilman Thomas & Battle, PLLC
Formed in 1864, Spilman Thomas & Battle, PLLC, is one of the largest law firms in West Virginia. The firm currently has more than 75 attorneys. The firm has two major departments: Corporate and Litigation. Within these departments, attorneys typically work in areas such as energy, environmental, government affairs, mergers and acquisitions, as well as labor and employment, among others.

Jackson Kelly, PLLC
Founded in 1822 and boasting over 150 lawyers today, Jackson Kelly, PLLC, is the oldest and largest law firm in West Virginia. The firm has ten offices located throughout West Virginia; Lexington, Kentucky; Denver, Colorado; and, the District of Columbia. Energy and environmental law are among the principal practice areas for the firm.

Significantly, the interviews yielded valuable insights for CO-OP, both in terms of approach and content. More significant details regarding stakeholder opinions on GHG background information, CO-OP data content, and CO-OP functionality follow.

4.1 Stakeholder GHG Background Information

All of the parties interviewed as potential stakeholders possessed a significant knowledge base with regard to GHG emissions management, GHG trading, and carbon sequestration. In fact, a number of the parties from which representatives were interviewed have already initiated GHG emissions management and carbon sequestration projects. This existing background allowed the dialogues regarding CO-OP to reach discussion of detailed analysis and recommendations regarding CO-OP data content and functionality requirements.

As background on the general stakeholder opinions on CO-OP, stakeholders indicated a belief that CO-OP could provide a valuable service by:

- Providing information to interested parties;
- Prompting action by interested, motivated parties; and,
- Positioning West Virginia for national leadership on GHG management.

More specifically, the stakeholders believed that the benefit to be derived by providing information to interested parties would aid in:

- Providing educational resources for users of CO-OP to advance their knowledge regarding the benefits of carbon sequestration and GHG emissions reduction or offset projects; and,
- Educating interested parties about the opportunities for carbon sequestration and GHG emissions management activities in their area of operation.

With regard to prompting action by interested, motivated parties, the stakeholders believed that CO-OP could play a role in:

- Minimizing the existing information gap between parties that would like to develop carbon sequestration or other GHG management projects and those parties that have a need to invest in these projects to meet entity goals;
- Allowing smaller entities to benefit from a network of connectivity regarding GHG management projects similar to that presently possessed by larger entities;
- Providing an initial screening process for parties interested in GHG emissions management and carbon sequestration investments, and, thus, serve to minimize transaction costs;
- Aiding in the creation and timely implementation of carbon sequestration and other GHG management projects;
- Mobilizing domestic parties to aid the goals of President George W. Bush's Global Climate Change Initiative; and,
- Ushering potential partners to markets like the emerging Chicago Climate Exchange™ to execute GHG-based contracts and trades.

Just as significantly, the stakeholders expressed a strong belief in the value of CO-OP as a method for positioning West Virginia for national leadership on GHG management by:

- Installing West Virginia and its resident entities as leaders in the arena of GHG emissions management and carbon sequestration by their role as the pilot for CO-OP; and,
- Advancing the science and approaches focused on mine land reclamation through terrestrial sequestration activities.

Thus, in general, stakeholders believed that CO-OP could be a strategic asset in local and national initiatives focused on GHG emissions management. In addition, the stakeholders expressed an interest in being involved as CO-OP design and development progresses, including potentially being involved on a CO-OP stakeholder advisory board. In fact, several stakeholders representative of industry associations and government expressed an interest in potentially serving as project hosts for CO-OP.

4.2 Stakeholder Opinions on Data Content

In the course of the interviews, the potential stakeholders indicated opinions regarding potential preferred data content for CO-OP. These opinions and insights included information pertaining to concerns about the ability of the data to convey the necessary information to meet present and future needs, as well as thoughts on specific data fields that would assist in facilitating interest in CO-OP.

In terms of the needs that must be met by the data conveyed in CO-OP records, the stakeholders indicated that CO-OP filings to buy, sell, or invest in a carbon sequestration or GHG emissions management project should be capable of:

- Matching 1605(b) program filing requirements;
- Providing educational resources for users of CO-OP to advance their knowledge regarding opportunities, options, and value;
- Remaining flexible to include additional information other than that available from structured data fields in order to meet any future voluntary or mandatory goals;

- Containing sufficient data to ensure that initial screening could occur by parties interested in becoming a counterparty on a possible transaction related to a posted offer to buy, sell, or invest;
- Providing potential future regulatory entities with appropriate and sufficient data to substantiate credit for early action on carbon sequestration and GHG emissions management; and,
- Detailing scientific, technical, and engineering justifications for project validity, including the justification for additional emissions reductions resulting from a project.

With regard to the actual data fields, in general, the stakeholders expressed a desire for a variety of information that could be available as a result of a complete filing to buy or invest in, or to sell or receive investment in a carbon sequestration or GHG emissions management project on CO-OP. This information could be grouped into four categories as follows:

- Offering organization information;
- Project data information;
- Technical methodology information; and,
- Project verification/validation information.

Due to significant differences in the data required for offers to buy or invest in projects, or offers to sell or receive investment in projects, the findings from the interviews relative to stakeholder opinions on data content will be recorded in this manner.

4.2.1 Data for Offers to Buy or Invest

For offers to buy or invest in projects, the required information indicated was confined to the first two categories – offering organization information and project data information.

For offers to buy or invest in projects, offering organization information noted as significant during the course of the interviews included:

- Offering organization name;
- Offering organization description;
- Offering organization contact;
- Offering organization contact mailing address;
- Offering organization contact telephone number;
- Offering organization contact facsimile number; and,
- Offering organization contact email address.

For offers to buy or invest in projects, desired project data information noted as significant during the course of the interviews included:

- Desired project sector(s);
- Desired project type(s);
- Desired project location(s), with city, county, state/province, country, mailcodes, etc.;
- Desired project total GHG emissions reduction or offset in terms of gas(es) and carbon dioxide equivalent;

- Desired project annual GHG emissions reduction or offset in terms of gas(es) and carbon dioxide equivalent;
- Desired project emissions reduction or offset unit price or price range;
- Desired project start date;
- Desired project active time period; and,
- Desired project applicability to specific compliance goals (i.e. local or state regulations).

4.2.2 Data for Offers to Sell or Receive Investment

For offers to sell, or receive investment in, projects, the required information indicated covers all four categories – offering organization information, project data information, technical methodology information, and project verification/validation information.

For offers to sell or receive investment, offering organization information noted as significant during the course of the interviews included:

- Offering organization name;
- Offering organization description;
- Offering organization contact;
- Offering organization contact mailing address;
- Offering organization contact telephone number;
- Offering organization contact facsimile number; and,
- Offering organization contact email address.

For offers to sell or receive investment, project data information noted as significant during the course of the interviews included:

- Project sector;
- Project type;
- Project location(s), with city, county, state/province, country, mailcodes, etc.;
- Project total GHG emissions reduction or offset in terms of gas(es) and carbon dioxide equivalent;
- Project annual GHG emissions reduction or offset in terms of gas(es) and carbon dioxide equivalent;
- Project emissions reduction or offset unit price or price range;
- Project start date;
- Project active time period; and,
- Project applicability to specific compliance goals (i.e. local or state regulations).

For offers to sell or receive investment, technical methodology information noted as significant during the course of the interviews included:

- Project emissions reduction or offset calculation methodology;
- Project additionality claim support;
- Project risk(s); and,
- Project risk management considerations.

For offers to sell or receive investment, project verification/validation information noted as significant during the course of the interviews included:

- Organization name of party performing verification/validation;
- Organization description of party performing verification/validation; and,
- Verification/validation methodology.

4.3 Stakeholder Opinions on Functionality

During the course of the interviews, the potential stakeholders indicated opinions regarding potential preferred functionality for CO-OP. Given that the basic proposed functionality for CO-OP had been outlined through a project briefing paper provided to the interviewees in advance of the interview session, these opinions and insights were fewer in number than those regarding data content.

Generally, the stakeholders agreed with the offered vision for CO-OP to provide a platform to catalog carbon sequestration and other related projects seeking investment and serve as a clearinghouse to match potential investors to these contemplated projects. To perform this function, stakeholders expressed interest in CO-OP allowing users to search the catalog by the above-referenced project data information which includes:

- Project sector(s);
- Project type(s);
- Project location(s);
- Project total GHG emissions reduction or offset in terms of gas(es) and carbon dioxide equivalent;
- Project annual GHG emissions reduction or offset in terms of gas(es) and carbon dioxide equivalent;
- Project emissions reduction or offset unit price or price range;
- Project start date;
- Project active time period; and,
- Project applicability to specific compliance goals (i.e. local or state regulations).

In addition to this search functionality, a number of stakeholders expressed an interest in allowing users of CO-OP to receive automatic notifications of potential matches to their posted offers to buy, invest, sell, or receive investment.

5.0 DOMAIN REQUIREMENTS ANALYSIS

Based upon the research conducted on analogous programs, possible requirements resulting from the structure of the USDOE 1605(b) program, and possible requirements based upon interviews with potential CO-OP stakeholders, a domain requirements analysis for CO-OP was compiled.

This domain requirements analysis included information on strategic goals, data content needs, and functionality demands. Details on the domain requirements are provided in the following portions of this report.

5.1 Strategic Goals

As envisioned, CO-OP would provide a platform to catalog carbon sequestration and other related projects seeking investment and serve as a clearinghouse to match potential investors to these contemplated projects. It is believed that this technology would aid government and non-governmental entities as they attempt to implement voluntary GHG management mechanisms and encourage industry and public investments in GHG and carbon sequestration activities and projects in their jurisdictions.

From the results of the research conducted on analogous programs, the 1605(b) program, and stakeholder viewpoints, three principal goals emerged regarding CO-OP. Thus, CO-OP should, in its design, development, and deployment, be structured to:

- Provide detailed information to stakeholders in carbon sequestration or GHG emissions management activities in order to assess opportunities for action;
- Catalyze action by stakeholders to take steps to initiate and complete carbon sequestration and other related GHG emissions management projects; and,
- Position West Virginia and future CO-OP adopters for national and international leadership on carbon sequestration and GHG emissions management.

5.1.1 Goals Related to Information

In terms of the needs that must be met by the data conveyed in CO-OP records, research indicated that CO-OP filings to buy, sell, or invest in a carbon sequestration or GHG emissions management project should be capable of:

- Providing educational resources for users of CO-OP to advance their knowledge regarding opportunities, options, and value;
- Educating interested parties about the opportunities for carbon sequestration and GHG emissions management activities in their area of operation;
- Containing sufficient data to ensure that screening could occur by parties interested in becoming a counterparty on a possible transaction related to a posted offer to buy, sell, or invest; and,
- Remaining flexible to include additional information other than that available from structured data fields in order to meet any future voluntary or mandatory goals.

5.1.2 Goals Related to Catalyzing Action

With regard to prompting action by interested, motivated parties, research indicated that CO-OP could play a role in:

- Minimizing the existing information gap between parties that would like to develop carbon sequestration or other GHG management projects and those parties that have a need to invest in these projects to meet entity goals;
- Allowing smaller entities to benefit from a network of connectivity regarding GHG management projects similar to that presently possessed by larger entities;
- Providing an initial screening process for parties interested in GHG emissions management and carbon sequestration investments, and, thus, serve to minimize transaction costs;
- Aiding in the creation and timely implementation of carbon sequestration and other GHG management projects;
- Mobilizing domestic parties to aid the goals of President George W. Bush's Global Climate Change Initiative; and,
- Ushering potential partners to markets like the emerging Chicago Climate Exchange™ to execute GHG-based contracts and trades.

5.1.3 Goals Related to Leadership

Just as significantly, research indicated the value of CO-OP as a method for positioning West Virginia and successive adopters of CO-OP as national and international leaders on carbon sequestration and GHG management by:

- Matching 1605(b) program filing requirements when possible;
- Providing potential future regulatory entities with appropriate and sufficient data to substantiate credit for early action on carbon sequestration and GHG emissions management; and,
- Detailing scientific, technical, and engineering justifications for project validity;
- Advancing the science and approaches focused on carbon sequestration activities; and,
- Installing West Virginia, its resident entities, and successive adopters of CO-OP as leaders in the arena of GHG emissions management and carbon sequestration through their early adoption and utilization of the technology.

Perhaps the most significant requirement resulting from this strategic goal requirements exercise is related to the informational goals. From the opinions expressed by the interviewed stakeholders, it can be concluded that informational resources on carbon sequestration and GHG emissions reduction or offset projects must be available on the CO-OP website in order to ensure that interested parties have access to the information that could be needed to facilitate initiation and filing of projects on CO-OP. Initially, this reference base could be provided through hyperlinks to various resources available from USDOE/NETL and other international leaders in the field.

5.2 Data Content Requirements

With regard to the actual data fields, in general, the stakeholders expressed a desire that the following information, when applicable, be available as a result of a complete filing to

buy or invest in, as well as sell or receive investment in, a carbon sequestration or GHG emissions management project on CO-OP:

- Offering organization information;
- Project data information;
- Technical methodology information; and,
- Project verification/validation information.

5.2.1 Data Requirements for Offer to Buy or Invest in a Project

As was the case with the stakeholder interviews, the required information for offers to buy or invest in projects will be confined to two sections of desired information – offering organization information and project data information.

Offering organization information critical to any offer to buy or invest in a carbon sequestration or other GHG emissions reduction or offset project includes:

- Offering organization name;
- Offering organization SIC (Standard Industrial Classification)/NAICS (North American Industry Classification System) code[1];
- Offering organization description;
- Offering organization contact;
- Offering organization contact mailing address;
- Offering organization contact telephone number;
- Offering organization contact facsimile number; and,
- Offering organization contact email address.

Project data information critical to any offer to buy or invest in a carbon sequestration or other GHG emissions reduction or offset project includes:

- Desired project sector(s) according to 1605(b) program definitions when possible;
- Desired project type(s) according to 1605(b) program definitions when possible;
- Desired project location(s), with city, county, state/province, country, mailcodes, etc.;
- Desired project total GHG emissions reductions in terms of gas(es) and carbon dioxide equivalent;
- Desired project annual GHG emissions reductions in terms of gas(es) and carbon dioxide equivalent;
- Desired project emissions reduction unit price or price range;
- Desired project start date;
- Desired project active time period; and,
- Desired project applicability to specific compliance goals (i.e. local or state regulations).

[1] The North American Industry Classification System (NAICS) was developed jointly by the United States, Canada, and Mexico to provide a uniform method of comparing statistical data associated with specific industry sectors. NAICS was developed to replace the U.S. Standard Industrial Classification (SIC) system.

It should be noted that in this requirements section, as well as all that follow, the phrase "according to 1605(b) program definitions when possible" has been utilized because detailed 1605(b) definitions and standards are not yet available for all carbon sequestration or related GHG emissions reduction or offset projects. For instance, as noted, there are very limited present 1605(b) standards for geologic carbon sequestration applications.

5.2.2 Data Requirements for Offer to Sell or Receive Investment in a Project

Resulting from the fact that offering entities filing an offer to sell or receive investment in a carbon sequestration or other GHG emissions reduction project could possess more detailed data than entities offering to buy or invest in similar projects, the data requirements for offering entities filing an offer to sell or receive investment in a given project would be more complex. Information on these data requirements follows and is, again, organized according to the categories of:

- Offering organization information;
- Project data information;
- Technical methodology information; and,
- Project verification/validation information.

Offering organization information critical to any offer to sell or receive investment in a carbon sequestration or other GHG emissions reduction or offset project includes:

- Offering organization name;
- Offering organization SIC/NAICS code;
- Offering organization description;
- Offering organization contact;
- Offering organization contact position title;
- Offering organization contact mailing address;
- Offering organization contact telephone number;
- Offering organization contact facsimile number; and,
- Offering organization contact email address.

Project data information critical to any offer to sell or receive investment in a carbon sequestration or other GHG emissions reduction or offset project includes:

- Project name;
- Project sector according to 1605(b) program definitions when possible;
- Project type according to 1605(b) program definitions when possible;
- Project characteristics description;
- Project location, with municipality, county (or equivalent political subdivision), state/province, country, mailcodes, etc.;
- Project total GHG emissions reductions in terms of gas(es) and carbon dioxide equivalent;
- Project annual GHG emissions reductions in terms of gas(es) and carbon dioxide equivalent;
- Project emissions reduction unit price or price range;
- Project start date;

- Project active time period;
- Project applicability to specific compliance goals (i.e. local or state regulations); and,
- Detailed project description.

Technical methodology information critical to any offer to sell or receive investment in a carbon sequestration or other GHG emissions reduction or offset project includes:

- Project emissions reduction or offset calculation methodology;
- Project additionality claim support;
- Project risk(s); and,
- Project risk management considerations.

Project verification/validation information critical to any offer to sell or receive investment in a carbon sequestration or other GHG emissions reduction or offset project includes:

- Organization name of party performing verification/validation;
- Organization description of party performing verification/validation; and,
- Verification/validation methodology.

5.3 Functionality Requirements

Based upon the research on analogous platforms, the 1605(b) program, and stakeholder insights, a group of CO-OP functionality requirements were determined. These functionality requirements were clustered around three core areas:

- Project entry;
- Catalog searching; and,
- Automated potential match notification.

5.3.1 Project Entry Functionality

The project entry functionality can be easily defined as the ability for the users of CO-OP to enter the information outlined in Section 5.2 of this report. This data content would allow parties interested in buying or investing in, as well as selling or receiving investment in, a carbon sequestration or GHG emissions management project to enter appropriate information related to:

- Offering organization information;
- Project data information;
- Technical methodology information; and,
- Project verification/validation information.

5.3.2 Catalog Searching Functionality

To aptly serve as a clearinghouse to match potential investors to these contemplated projects, CO-OP should allow users to search the catalog for significant information drawn from the above-referenced project data. Searchable functions for CO-OP should include the opportunity to query by:

- Project sector(s);

- Project type(s);
- Project location(s);
- Project total GHG emissions reductions in terms of gas(es) and carbon dioxide equivalent;
- Project annual GHG emissions reductions in terms of gas(es) and carbon dioxide equivalent;
- Project emissions reduction unit price or price range;
- Project start date;
- Project active time period; and,
- Project applicability to specific compliance goals (i.e. local or state regulations).

5.3.3 Automated Potential Matching Notification Functionality

In addition to this search functionality, CO-OP should be able to provide functionality to allow users of the technology to receive automatic notifications of potential matches to their posted offers to buy, invest in, sell, or receive investment. Notification of possible matches would rely upon the data content provided by the users and be structured to mirror the searchable data fields outlined in Section 5.3.2 above.

6.0 TECHNICAL REQUIREMENTS

The following section outlines the preliminary technical requirements necessary for the development of an initial version of CO-OP based upon the domain requirements gathered in Section 5.0 of this report. This overview addresses technical requirements with regard to both software development tools and technical personnel. In addition, this section provides a brief high-level description of some of the steps that will be required to complete the software development process of an initial version.

This section provides some options for development; however, based upon the final determination of requirements and the hosting option selected, these suggestions may change. These options assume that the application will be housed on a website dedicated to CO-OP. The development requirements are separated into four primary categories, as follows: software development tools; web hosting; technical personnel; and, preliminary software development process.

6.1 Software Development Tools

As previously stated, in order to maximize the accessibility of CO-OP, the application will be designed using web-based technology. There are a variety of web-based development tools currently available.

6.1.1 Database Tools

The primary functionality of CO-OP is its ability to allow users to create, store, and search records. This functionality requires the development of a relational database system. Possible tools for consideration include Microsoft SQL Server 2000, Oracle9i Database, and IBM DB2 database technologies. Important factors for consideration for tool selection include: scalability; security features; Internet query capabilities; and, data mining capabilities.

6.1.2 Interface Tools

The interface will be a fundamental factor in the success of CO-OP. A simple, well-designed, user-friendly interface will be important to attract initial users. Microsoft, Oracle, IBM, as well as other vendors offer development tools that could be used to meet this need. Tools that lend themselves to rapid development projects would be good solutions for this particular project.

6.1.3 Software Documentation Tools

Depending upon the type of help documentation deemed most beneficial for CO-OP, software documentation tools may be necessary. Help documentation for CO-OP could range from a downloadable PDF user manual to an integrated online help system. There are a broad range of help documentation software tools available, ranging from freeware to sophisticated programs such as RoboHelp offered by eHelp Corporation and WebWorks offered by Quadralay Corporation. It is anticipated at this time, that the best solution for CO-OP is to use HTML to develop the online help system.

6.2 Web Hosting

Web hosting accommodations will need to be selected for housing CO-OP. During the initial development of CO-OP, the application can be built on a development server with minimal hosting requirements since during this phase the site will not be accessed by the public.

Once an initial version of CO-OP has been developed and initial testing has been completed additional web hosting requirements will be necessary for the live version of CO-OP.

The development tools selected will influence the hosting requirements. Requirements that will need to be addressed regardless of the software development tools utilized include bandwidth, firewall protection, virus protection, data backup, security, maintenance, and administration access. The size of the CO-OP database and the projected number of simultaneous users will be two important factors in determining additional hosting and bandwidth requirements in order to ensure optimal functionality of the application. These requirements will need to be analyzed once preliminary development and testing have taken place.

6.3 Technical Personnel Skills

Based upon the domain requirements gathered to date and initial design concepts it is estimated that the primary skills required for the development of CO-OP include: database design; HTML; script and web-based programming; and, user interface design.

Additionally, personnel will be required to develop help documentation for the application. At this time it is expected that the documentation will focus on basic functionality as well as aiding the user in understanding the definitions and terminology used in categorizing and describing projects in order to ensure consistency across users.

6.4 Preliminary Software Development Process

Based upon the domain requirements gathered to date, using an aggressive, rapid development approach, it is feasible for an initial version of CO-OP to be developed in a relatively short timeframe. The following list provides a brief, high-level overview of some of the key technical steps necessary to complete an initial version. Some of the steps listed below will be pursued simultaneously.

Software Development Plan
The first step would be to develop a formal software development plan for this initiative. This would include outlining all phases of the software development lifecycle and the approach to be used to complete the effort.

Formal Software Requirements Analysis
Based upon the domain requirements established during this phase of the initiative a formal software requirements analysis needs to be conducted. This step includes drafting a very specific and systematic list of all functional and interface requirements for inclusion in CO-OP. This list of requirements will be

used by the software development team to track the functionality of the application.

Interface Design
Based upon the functional requirements, an interface design needs to be developed.

Database Design
Database design would be performed in tandem with the interface design. The database would serve as the backbone for CO-OP.

Coding and Unit Testing
Coding and testing includes the writing of the code and testing components as they are developed. Unit testing would be conducted by the software development team.

Documentation Development
Online help documentation would need to be developed to assist users in using CO-OP.

Testing, Stakeholder Feedback, and Enhancements and Fixes
Internal testing would need to occur to confirm that requirements have been met and that the application is functioning optimally. Once this has been established, it is recommended that CO-OP be demonstrated for some of the stakeholders that participated in the domain requirements gathering in order to receive comments and suggestions pertaining to the functionality and design. Additionally, time would be needed to fix any defects found in the application as well as to incorporate enhancements gathered through testing by and demonstrations to stakeholders.

As noted above, the purpose of this section is to provide a general idea of the level of technical effort necessary to complete an initial version of CO-OP. Based upon the domain requirements developed, it would appear to be feasible to complete an initial version within a six to seven month period.

7.0 CONCLUSIONS

7.1 Conclusions

Based upon the research conducted during the prior phase of activities, it appears that there is a technological and market need for CO-OP as well as an interest in development and utilization of CO-OP, at least among the interviewed stakeholders in West Virginia.

As noted, public and private planners have access to a small number of tools with limited functionality with which to perform their quest for seeking best options for GHG emissions management policy and business strategies. Thus, there is a need for technology advancements and innovations focused on producing additional tools for states, other governmental subdivisions, and non-governmental organizations to utilize in GHG emissions management planning, especially regarding catalyzing carbon sequestration investment opportunities.

CO-OP could provide a platform to catalog carbon sequestration and other related projects seeking investment and serve as a clearinghouse to match potential investors to these contemplated projects. With substantial research on the domain requirements and technical requirements performed, the final requirements that must be addressed are related to program hosting and positioning of an advisory body for the final design, development, and deployment of CO-OP.

Appendix A: Terrestrial Sequestration Project Information

The following section provides additional detail regarding reporting of project information for Part II of Section 8, Carbon Sequestration, of the 1605(b) reporting process.

Project Type

Reporter must select from the following options regarding the project type in order to best describe the type of project undertaken.

Afforestation: Planting trees in an area that has not recently been forested, thereby changing the land use from a non-forest use such as crop or pasture.

Reforestation: Planting trees in a recently harvested forest area.

Urban Forestry (Sequestration Effects Only): Planting of trees in urban or suburban areas to sequester carbon.

Forest Preservation: Protecting an existing forest from harvest or conversion to another land use.

Modified Forest Management: Improving the management regime of an existing forest to increase carbon storage in the forest or reduce the release of greenhouse gases resulting from forestry activities. Activities include treatments such as fertilization and prescribed fire, as well as site preparation techniques at the time of harvest and regeneration such as mechanical site preparation, site preparation burning, and chemical site preparation.

Agroforestry: Combining agriculture and forestry on the same land area to provide agricultural products with less intensive energy uses and sequester more carbon than traditional agriculture.

Woody Biomass Production: Planting and harvesting trees for the purpose of displacing fossil fuels as an energy source.

Wood Products: Increasing wood products usage so that carbon is stored over the long term in wood products that substitute for non-wood products such as steel, aluminum, and portland cement.

Conservation Tillage: Adopting conservation tillage methods such as reduced till or no till that increase carbon storage on cropland compared to conventional tillage methods.

Other: Activities not included in any of the previous project types. Space is provided for a brief description of the project.

Forest Composition

In the forest composition field the reporter is asked to indicate, using a percentage, the type of forest (or other crop type, if applicable) that the project involves. The reporter enters "NA" if this question is not applicable.

Example 1: A reforestation project is conducted and loblolly pine is the planted forest type, the forest composition associated with this project should be reported as 100% loblolly pine.

Example 2: A forest preservation project occurs in two areas of 100 acres each. In one area, an oak-hickory forest was preserved. In the other, a white-red pine forest was preserved. The forest composition associated with this project should be reported as 50% oak-hickory, 50% white-red pine.

Historic Land Use

In the historic land use field the reporter is asked to indicate what the land was previously used for, and, where applicable, specify the type of forest/crop in the area prior to the initiation of the project. If the historic land use was not forest, cropland, or pasture, the reporter should check "Other" and describe the prior land use. For a "Wood Products" project the reporter should indicate "Not applicable."

Example: If the previous land use of an afforestation project was growing corn, then the historic land use would be described as “cropland” and entering "corn" for crop type.

Reference Case Land Use

In the reference case land use field the reporter is asked to specify the type of forest/crop or land use that was assumed for the reference case. If the reference case is not forest, cropland, or pasture, the reporter should select "Other" and specify the reference case land use.

Example: If it is assumed that the land use would have been growing corn if the afforestation project had not occurred, then the reference case land use would be described as cropland and entering "corn" for crop type.

Project Characteristics

In the project characteristics section the reporter is asked to describe the characteristics of the project by completing a table. If a particular characteristic does not apply to the project, the reporter should enter "NA". The information reported should be in annual increments for the project activity (e.g., the area planted in the reporting year). The reporter should not report cumulative values, such as the number of trees planted from the start of the project through the reporting year. For each row, the information listed below should be reported.

Note 1: If reporting an urban forestry project, only the "Trees Planted During Year" row needs to be completed.

Note 2: For a joint venture project, report the portion of the total fuel/energy consumption corresponding to the share of emissions or reductions reported in Part III.

Area Affected During Year: Indicate the additional area planted (or otherwise affected) in each year. For projects involving activities other than tree planting, only new activity should be reflected, e.g., for forest preservations, enter the additional area preserved

each year. This value is recorded in physical units such as acres, hectares, square feet, square meters, or square miles.

Trees Planted During Year: Specify, per unit area, the average number of trees that were planted/grown in the project area in each year.

Timber Productivity: If relevant, provide an estimate of the increase in the total annual cubic-foot volume growth per acre that is a result of the project.

Planned Harvest Age: If reporting on a forestry project in which the trees will ultimately be harvested, provide the age of the trees at the anticipated date of harvest.

Mean Age of Trees (or Stands) During Year: If reporting on activities that affect a single existing forest stand, record the age of the trees in that stand. If reporting on activities that affect more than one stand, record the mean age of all the stands. For a project involving tree planting, enter the age of the trees or stands in the reporting year. For other projects, enter the age of the trees or stands affected by the activity, e.g., for forest preservation, enter the age of the stands being preserved in the year when preservation commences.

Project Description

The project description field asks the reporter to describe the project, explaining its basic nature and general characteristics, and the manner in which it sequestered carbon or reduced emissions. All information important to understanding the project and its effects on emissions or sequestration should be included, as well as any special conditions that would be necessary to replicate its achievements.

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