Chapter 9 CCX Exchange Offsets and Exchange Early Action Credits

9.0 Purpose (2006)

This Chapter:

- defines CCX Exchange Offsets (XOs) and Exchange Early Action Credits (XEs);
- provides XO and XE Project eligibility rules and other technical specifications; and,
- describes CCX Project registration, verification, audits and aggregation of CCX Exchange Offsets.

Chicago Climate Exchange recognizes the following categories of Exchange Offsets:

- Exchange Methane Offsets (XMO)
- Exchange Soil Offsets (XSO)
- Exchange Forestry Offsets (XFO)
- Exchange Early Action Credits (XE)
- Exchange Offsets for Electricity Produced from Renewable Energy (XRE)
- Exchange Emission Reductions (XER)
- Exchange Fuel Conversion Offsets (XFCO)
- Exchange Fluorocarbon Destruction Offsets (XFDO)

Other types of offset projects may be recognized as they become technically and commercially available.

9. 1 General Provisions (2006)

All Projects proposed for registration with CCX are subject to approval by the CCX Offsets Committee.

An entity that has an emission profile greater than 10,000 metric tons CO_2 equivalent annually makes it eligible to be a CCX Member. Such entity may register and trade CCX Exchange Offsets only if the entity is a Member of CCX unless it qualifies under the provisions of CCX Rule 9.7.1.1.[1,2]

[1] Emissions reductions realized at facilities that are included in a Member's CCX emission inventory are not Offset Projects as they cause a decrease in recognized emissions and a decrease in the number of Carbon Financial Instrument contracts needed for compliance.

[2] CCX will not accept registration of Offsets or Offset Projects that are owned (in full or partially) by an entity that is eligible to be a CCX Member but is not a Member. This prohibition also extends to entities that may have no direct ownership but have a beneficial interest in such Offset Project(s). A CCX Member that is a partial owner of an eligible Offset Project may register with CCX its legally-owned Offsets from the project, regardless of whether

Certain Offset Projects undertaken by CCX Members prior to 1999 will be eligible to earn Exchange Early Action Credits in accordance with the provisions of Section 9.7.

Provisions contained in Section 4.11.5 of this *Rulebook* govern use of Exchange Offsets and Exchange Early Action Credits in the CCX True-up process. Eligible Projects that are operated by CCX Members and CCX Offset Providers are defined as "Owned and Operated" Projects. Usage and sales of XOs and XEs issued to CCX Member Owned and Operated Projects are addressed in Section 4.11.6 of this *Rulebook*.

Registration of a project must be submitted in accordance with CCX processes and procedures. A CCX-approved Verifier shall conduct verifications (including in-field inspections when prescribed) of enrolled Projects. Such verifications shall document Project start dates (when applicable) and other records as may be specified by CCX. The CCX-approved Verifier will submit a report in accordance with CCX procedures. Unless otherwise specified by the Exchange, the cost of the annual verification shall be borne by the Project Owner.

CCX, or its Provider of Regulatory Services, shall undertake audits for the purpose of confirming that CCX-approved Verifiers have properly documented Project eligibility and effectiveness in conformance with CCX rules. All Projects registration documents, verification reports, related documents and documentation of quantification methods shall be subject to inspection and audit. Additional provisions governing audits of Exchange Offset Projects are provided in Chapter 10 of this *Rulebook*.

9.2 Rule Interpretation and Modifications (2006)

Unless otherwise provided in this *Rulebook*, applicable CCX Committees shall be responsible for recommending interpretations and appropriate modifications of rules established in this Chapter to the Exchange. The CCX Offsets Committee is responsible for reviewing all proposed interpretations and modifications and shall have final decision-making authority regarding this Chapter.

9.3 Project Registration, Aggregation, Verification and Reporting (2006)

In order to earn CCX Exchange Offsets, the Project Owner or Aggregator (for the purposes of this Chapter, these terms may collectively be referred to as "Project Owner" unless specifically referred separately) of each CCX-eligible Project must

---

the other owner(s) of the project are CCX Members. For such projects, the CCX Member may register a quantity of offsets up to the amount that corresponds to its percentage ownership share or beneficial interest of the project.

(1) be a CCX a Member, CCX Offset Provider or CCX Offset Aggregator ;
(2) register the Project with CCX;
(3) obtain independent verification of the Project by a CCX-approved Verifier; and
(4) periodically report to CCX the status of the Project.

Unless otherwise allowed by the CCX Offsets Committee, a CCX Project Owner may directly register a Project with CCX without an Aggregator and may directly execute trades on the CCX Trading Platform as a CCX Member, a CCX Offset Provider or CCX Offset Aggregator if it qualifies under Section 2.6.1 for access to the Trading Platform.

If a CCX Project Owner does not meet this requirement, Project Registration and trading of CCX Exchange Offsets must be undertaken on its behalf by a CCX Offset Aggregator that meets the requirement.

With the exception of certain small Projects (as specified below), each Project Registration Filing and each periodic Project Report must be accompanied by a verification statement signed by a CCX-approved Verifier.

As specified below, registration of certain CCX Offset Projects must be accompanied by a Project eligibility statement prepared by a CCX-approved Verifier. The Project Registration Filing must also contain a signed attestation that the entity registering as the CCX Project Owner holds full legal title to the greenhouse gas mitigation rights registered as CCX Exchange Offsets that are associated with the facilities and sites included in the registered Project.

As specified below, the performance of each CCX Project must be quantified and reported (and, as prescribed, verified) in accordance with the provisions of this Chapter. Each Project Owner must submit a Project Report to the Project's Aggregator (for Projects registered through an Aggregator) or directly to CCX. Each Aggregator shall submit to CCX a summary report reflecting the status of and quantity of mitigation achieved by all Projects it represents, using forms to be provided by the Exchange.

Unless specifically authorized by the CCX Offsets Committee, Exchange Early Action Credits (XE) must be registered with CCX within twelve months of the Membership approval date. (2006)

9.3.1 CCX Offset Aggregator (2006)

Entities that meet the qualifications provided in Section 2.3 can be accepted as CCX Offset Aggregators. For-profit entities, cooperatives, governmental bodies and non-profit organizations may act as CCX Offset Aggregators. Eligible entities must apply for CCX Offset Aggregator status by filing applicable CCX forms.

As per the provisions described below, Carbon Reserve Pools established for CCX forest and soil carbon Projects shall be established for the entire pool of Offsets represented by each CCX

Offset Aggregator. CCX Offset Aggregators may charge fees for services they provide to Project Owners. CCX Offset Aggregators shall have the discretion to refuse to represent individual Projects.

A CCX Offset Aggregator will be assigned an account in the CCX Registry and must meet the eligibility requirements to have access to the CCX Trading Platform. A CCX Offset Aggregator shall undertake the following actions on behalf of CCX-registered Projects it represents

(1) accept initial registration forms from owners of CCX-eligible Projects;
(2) assemble Project Reports from Project Owners, retain copies of Project verification records;
(3) submit Offset registration fees to CCX;
(4) have sole authority to access the Registry Account(s)[3] holding the Offsets issued to Projects it represents and to access the CCX Trading Platform as an Authorized Trader; and,
(5) execute sales on the CCX Trading Platform on behalf of Project Owners and distribute sales proceeds to Project Owners in accordance with the terms agreed between the Aggregator and Project Owners.

The terms of the business and legal relationships between Aggregators and Project Owners are left to the discretion of those parties.

9.3.2 CCX Registered Offset Advisor (1/21/2004)

The role of a CCX Registered Offset Advisor is to:

- Act as a clearinghouse for project developers, providing advice and recommendations to CCX on the initial suitability and reputations of projects.
- Provide technical and logistical assistance to project developers who wish to submit projects for consideration or registration with CCX.

Addition of CCX Registered Offset Advisors and their geographic coverage is subject to approval of the CCX Offsets Committee. CCX Registered Offset Advisors are subject to the supervision of the CCX Offsets Committee.

CCX Registered Offset Advisors cannot act as aggregators, verifiers or offset providers.

9.4 Offset Issuance (2006)

CCX-eligible Offset Projects can be recorded in the CCX Registry and will be issued Exchange Offsets on the basis of the entire recognized mitigation tonnage realized during Phase I and

[3] All categories of CCX members are entitled to one account in the CCX registry as part of their membership. Additional accounts may be established in the CCX Registry for a fee determined by CCX.

Phase II Market Periods. The quantity of mitigation achieved by each Offset Project shall be quantified on the basis of metric tons of carbon dioxide (CO_2) equivalent. Each Exchange Offset will represent one hundred metric tons of carbon dioxide (CO_2) equivalent and will be identified by annual Vintage. The minimum trading unit is one Exchange Offset or one CFI contract.

Exchange Offsets and Exchange Early Action Credits will be issued only if all required documentation is presented to CCX. Subject to provisions in Chapter 4 of this *Rulebook,* Exchange Offsets and Exchange Early Action Credits will be recognized as equivalent to Exchange Allowances when surrendered for Compliance. XOs and XEs may be used for Compliance in their designated Vintage year or in later years. The Vintage year assigned to XOs and XEs shall correspond to the year in which the associated Greenhouse Gas mitigation occurs subject to the provisions of Section 4.11.6 of this *Rulebook*, except that XEs earned prior to 2004 will be assigned a Vintage of 2004 (or later Vintages, subject to recommendations of the CCX Offsets Committee).

CCX may issue offsets on the basis of annual emission mitigation. CCX may also issue Offsets for certain projects more frequently with the submission of the required documentation to CCX.

9.5 CCX Offset Project Terms and Conditions

By registering a Project with CCX, each Project Owner agrees to and acknowledges the CCX Transaction terms and conditions provided in Section 5.5, Figure 5.1 as well as the additional Terms and Conditions provided in Figure 9.1.

Figure 9.1 Additional Terms and Conditions Associated with CCX Offset Projects and Exchange Offsets (2006)

(1) The enrolled Project meets all applicable eligibility rules of the Chicago Climate Exchange.

(2) CCX will issue to the CCX Registry Account of the Project Owner or its designated CCX Offset Aggregator a quantity of Exchange Offsets based on the entire recognized mitigation tonnage approved by CCX and that conforms to the Rules provided in this Chapter subject to the provisions of Section 4.11.6 of this *Rulebook*

(3) Each sale of Exchange Offsets executed through the Chicago Climate Exchange shall represent a complete transfer of all legal rights associated with the mitigation of Greenhouse Gases that causes the issuance of CCX Offsets. The transferred legal rights are those corresponding to the quantity and Vintage of the Exchange Offsets issued in accordance with the terms and conditions provided in this section and other applicable Rulebook sections.

(4) The Project Owner or its CCX Offset Aggregator may sell or retain the Exchange Offsets earned under the provisions of this agreement.

(5) The Project Owner or its CCX Offset Aggregator may elect to deregister the Exchange Offsets once registered with CCX. The Project Owner or its CCX Offset Aggregator must deregister Exchange Offsets prior to entering into an agreement to sell the associated emission reductions outside of CCX.

(6) The Project Owner shall retain full legal ownership of all rights associated with the mitigation of Greenhouse Gases that may accrue:
  - (a) on lands or via activities not included in the CCX-registered Project;
  - (b) in excess of the quantity of Exchange Offsets issued by CCX to CCX-registered Projects; or,
  - (c) during periods prior to registration of a project with CCX and subsequent to time periods for which the project realized Offsets through CCX participation.

(7) CCX makes no warranty as to the marketability or market value of CCX Exchange Offsets.

(8) Each Project Owner, and, when applicable, its CCX Offset Aggregator, is required to periodically submit a signed Project Report that confirms conformance with the terms herein. Representatives of CCX may conduct on-site inspection of registered Projects and related documents. Each Project Owner agrees to provide access in such cases in a prompt and cooperative manner. All CCX Exchange Offset Projects, Project Reports and verification reports are subject to inspection and audit by the Provider of Regulatory Services designated by CCX and by other independent experts as may be engaged by CCX.

(9) CCX may request additional information and/or access to registered Projects for the purpose of advancing understanding of Greenhouse Gas mitigation Projects:
  - (a) Project Owners may decline such access without penalty; and,
  - (b) In no cases shall research findings cause a reduction in the quantity of Exchange Offsets to be issued to a registered Project.

(10) Additional terms and conditions are prescribed for individual Project types in other sections of this Chapter.

(11) Failure to conform to the rules provided herein may result in termination of enrollment in CCX and prohibition from all further participation in CCX.

9.6 Additional CCX-Eligible Projects (2006)

The CCX Offsets Committee may approve additional Project types and locations. In the process of evaluating additional project types, the CCX Offsets Committee may observe the following principles, which have been used in the establishment of the provisions of this Chapter:

(1) eligibility criteria and Offset issuance quantities shall reflect the best available scientific and technical information, as evidenced by peer-review published studies and other high-quality research findings;

(2) conservative Offset issuance rates (e.g. application of discounted Offset values, use of Forest Carbon Reserve Pool);
(3) balancing requirements for adequate documentation and verification of environmental effectiveness with the goal of minimizing transaction costs;
(4) compatibility with emerging international standards; and,
(5) avoidance of negative environmental and social impacts.

9.6.1 Terms and Conditions for Accepting Emission Reductions from Projects approved by the Clean Development Mechanism As Exchange Offsets for Use or Sale in CCX (2008)

9.6.1.2 Approval by CCX Offset Committee

Use of emission reductions from projects approved by the Clean Development Mechanism (CDM) in Chicago Climate Exchange shall be allowed only if approved by the CCX Offsets Committee.

9.6.1.3 Eligible Projects, Crediting Rates

Unless specific circumstances warrant otherwise, CDM-approved projects that conform to existing CCX offset project categories shall be considered CCX-eligible, subject to the other Terms and Conditions provided herein.

Conversion of emissions reductions from CDM approved projects to CCX Carbon Financial Instrument contracts shall be conducted in a manner that results in net issuance of CCX CFI contracts to particular project types at rates that conform to the Exchange Offset issuance rates applied to projects specified in the CCX rulebook or as determined by the CCX Offsets Committee**.**

9.6.1.4 Ineligible Project Types

CDM approval notwithstanding, the following project types are not eligible to be registered on CCX unless the project also satisfies the CCX project methodologies:

- Hydro power
- Forestry
- Other CDM Approved projects or methodologies that result in net increases in emissions to the atmosphere

9.6.1.5 Avoidance of Double Counting

Interface between the CDM registry and CCX shall assure that CERs shall only be used for compliance once. Exchange of CERs for CFI contracts can occur through the following mechanisms, or another mechanism that may be deemed appropriate once the CDM registry is activated:

(1) CERs may be exchanged for CCX CFI contracts by delivering CERs to a CCX account in the CDM registry and transfer on by CCX to a CDM registry retirement account. Upon retirement of the CERs, the entity that transferred CERs to the CCX CDM account will be issued CFI contracts to its CCX Registry Account.

(2) CERs may be exchanged for CCX CFI contracts by presenting to CCX documentary evidence that demonstrates that CERs have been transferred to a CDM registry retirement account in the name of Chicago Climate Exchange (and for no other purpose). Upon presentation of such evidence, the entity that retired CERs will be issued CFI contracts to its CCX Registry Account.

9.6.1.6 Projects Which Use CDM or Other Emission Reduction Methodologies

Where a project is not CDM approved but uses a CDM emission reduction methodology or methodology other than one included in the CCX Rulebook, the project must receive a determination of eligibility by CCX and approval to use the proposed quantification methodology.

9.7 Exchange Methane Offsets (XMOs) (2007)

Exchange Methane Offsets will be issued to owners of GHG emission reductions achieved by landfill, agricultural and coal mine methane collection and combustion systems as provided below, or as approved by the CCX Offset Committee.

9.7.1 Landfill Methane Offsets (2007)

Exchange Methane Offsets will be issued to owners of GHG emission reductions achieved by landfill collection and combustion systems placed into operation on or after January 1, 1999. Landfill methane collection and combustion systems in the U.S. may be registered with CCX and may earn XMOs only for mitigation occurring during time periods for which the landfill was not required to collect and combust methane in accordance with U.S. regulations (federal, state, local or provincial) requiring such actions, such as New Source Performance Standards or other applicable regulation. Landfill methane combustion occurring in countries outside of the U.S. may earn XMOs only for mitigation that is not required under the any legal requirement of such country. XMOs will be issued on the basis of metric tons of methane destroyed, net of CO_2 released upon combustion, during the Phase I and Phase II Market Periods, at a net rate of 21 metric tons CO_2 for each metric ton of methane combusted.

Appendix 9.1A provides the protocol to be employed in quantifying landfill gas methane combustion for CCX XMO Projects.

9.7.1.1 Registration of CCX Offsets by Governmental Entities Having Minor Direct Emissions (2007)

Governmental entities that have Direct Emissions below 25,000 metric tons CO_2 during the most recently completed calendar year are allowed to register CCX-eligible landfill methane offset projects without having to commit their Direct Emissions to the CCX reduction schedule.[4] Governmental entities availing themselves of this provision are required to retire 10% of their registered offsets on an annual basis, up to a maximum retirement amount of 5,000 metric tons CO_2 per year. A governmental entity will be limited to the sale of Carbon Financial Instrument contracts representing 50,000 metric tons of CO_2 per Vintage. In order to sell Carbon Financial Instrument contracts in excess of the 50,000 metric tons of CO_2, a government entity must apply and be approved as a CCX Member subject to the CCX emission reduction rules.

All CCX project eligibility (including start dates, absence of regulatory requirement to collect the methane) and verification rules apply. The Exchange has the right to limit the number of participants under this provision.

9.7.2 Agriculture Methane Emission Destruction (2007)

Eligibility

Projects eligible for agriculture methane offsets must have prior (baseline) manure management practices[5,6], where manure is handled as a liquid and with significant methane emitting potential, including:

1. Liquid/slurry storage
2. Pit storage below animal confinements (for periods exceeding one month)
3. Uncovered anaerobic lagoons

Eligible projects with baseline manure management systems other than those listed above may include only that portion of the manure handled by eligible systems in any baseline emission and Offset calculations.

[4] This provision will not apply to an entity whose Direct Emissions are less than or equal to 10,000 metric tons CO_2 per year as per CCX Rule 9.1. If an entity experiences a material change in emissions, the entity must inform CCX and it may affect its status with respect to CCX Rule 9.7.1.1.
[5] IPCC 2000, Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (May 2000)
[6] Table 10.18. Definitions of Manure Management Systems. 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Although the use of non-manure feedstocks may result in additional emission reductions, such use should be treated as a separate project activity and is not included in the specific calculation of agricultural methane Offsets for anaerobic manure digester projects.

Baseline calculation

The emissions baseline is the amount of methane that would be emitted to the atmosphere during the crediting period in the absence of the anaerobic digester project. For each year during the crediting period, baseline emissions for all anaerobic digesters are calculated as specified in paragraph (a) and paragraph (b) below, and the lower of the two values will be used:

(a) Actual monitored amount of methane captured and destroyed by the project activity using existing CCX monitoring protocols and a global warming potential for methane of 21. The default methane combustion efficiency for flared biogas from anaerobic digesters is 90%. Higher efficiencies may be used if supported by manufacturer's specifications or other acceptable data. The default methane combustion efficiency for biogas utilized by electricity gensets is 100%.

(b) The methane emission calculated *ex ante* based on the amount of the animal manure that would decay anaerobically in the absence of the project activity, using the most recent country-specific IPCC tier 2 approach.

Appendix 9.1B provides the protocol to be employed in quantifying methane combustion by agricultural methane projects.

The Project Verifier must document (among other items):

(1) the Project Owner's clear ownership rights to Greenhouse Gas emission reductions associated with sites included in the Project;
(2) eligibility of the site to earn CCX XMOs; and,
(3) records of methane content and total gas flows or total electricity generation and engine manufacturer's efficiency rating (if applicable).

9.7.3 Coal Mine Methane Emission Destruction (2007)

9.7.3.1 Applicability

This protocol applies to methane recovered from active and abandoned coal mines using the following extraction techniques:

(1) Pre-mining drainage wells (from the surface or underground) associated with mining activities at active coal mines;
(2) Post-mining drainage wells (from the surface or underground) associated with mining activities including from sealed mine areas; and

(3) Ventilation air methane from ventilation fans.

9.7.3.2 Eligibility

To be eligible to earn Offsets, any methane-extraction technique used at active coal mines must be approved for use by Mine Safety and Health Administration (MSHA) or equivalent non-U.S. mining regulatory agency rules. CCX eligibility requirements for methane to be included for registration are as follows:

(1) Methane produced from pre-drainage wells will be limited to wells drilled after January 1, 1999.
(2) Methane produced from pre-drainage wells will only be eligible after the well is mined through.
(3) All methane produced from pre-drainage wells from within a -50 meter to +150 meter vertical range of the mined coal seam will become eligible when the well is mined through.
(4) Methane produced outside the vertical limit can become eligible if the candidate project(s) demonstrate sufficient analytical evidence, consistent with IPCC Tier 3 Methodology, which connects methane generated outside the established vertical range to the mined seam in question.
(5) All methane produced from qualifying wells at abandoned coal mines will be eligible.

9.7.3.3 Specific Registration Criteria

CCX requirements for crediting methane recovery from coal mines as Offsets include the following.

9.7.3.3.1 Phase I Registration and Trading

(1) Pre-Mining Activities:

a. CMM collected from wells drilled after January 1, 1999, and mined around or through after January 1, 2003, can be registered and traded on CCX.

(2) Post-Mining Activities:

a. CMM from any well drilled after January 1, 1999, and collected after January 1, 2003, can be registered and traded on CCX.
b. CMM from any well drilled prior to January 1, 1999, and collected after January 1, 2003, which is: 1) processed/refined through a low quality gas facility, constructed after January 1, 1999, or 2) utilized in a low quality combustion

process (i.e. reciprocating engine, boiler, flare), constructed after January 1, 1999, can be registered and traded on CCX.

c. CMM from any well drilled prior to January 1, 1999 and collected after January 1, 2003, which is not 1) processed/refined through a low quality gas facility, constructed after January 1, 1999, or 2) utilized in a low quality combustion process (i.e. reciprocating engine, boiler, flare), constructed after January 1, 1999, cannot be registered and traded on the CCX.

9.7.3.3.2 CCX Phase II Registration and Trading

(1) Pre-Mining Activities:

a. CMM collected from wells drilled on or after January 1, 1999, and mined through after January 1, 2007, can be registered and traded on the CCX.

b. All CMM from any well drilled before January 1, 1999, and mined through on or after January 1, 2007, can be registered but not traded on the CCX.

(2) Post-Mining Activities:

CMM from any well drilled at any time, collected on or after January 1, 2007, which is processed / refined through a low quality gas facility, constructed after January 1, 1999, or utilized in a low quality combustion process placed into commercial operation on or after January 1, 1999, can be registered and traded on the CCX.

Appendix 9.1 C provides the protocol to be employed in quantifying methane combustion by coal mine methane projects.

9.7.4 XMO Project Registration, Verification and Project Reports

Registration of each CCX XMO Project must be accompanied by a Project eligibility statement prepared by a CCX-approved Verifier. The Project Registration Filing must include a signed attestation that the entity registering as the CCX Project Owner holds full legal title to the Greenhouse Gas mitigation rights registered as CCX Exchange Offsets that are associated with the facilities included in the registered Project. The filings must contain an attestation by a CCX-approved Verifier as to the quantity of mitigation achieved and Exchange Offset issuance that is prepared in conformance with the rules provided herein, and with the verification protocols prescribed by the Exchange.

9.8 Exchange Forestry Offsets (XFOs)

9.8.1 General Provisions

Exchange Forestry Offsets will be issued to owners of CCX-eligible Forestry Projects that are registered with the Exchange. As provided below, XFOs will be issued on the basis of increases in Carbon Stocks or avoided deforestation, quantified in metric tons of carbon dioxide (CO_2) equivalent, realized during the Phase I and Phase II Market Periods.

The rules and methods to be applied to quantification of Exchange Forestry Offsets are intended to be harmonized with those established for quantification of changes in Carbon Stocks by CCX Members in the forest products sector. Those rules and methods are provided in Chapter 8 of this *Rulebook.*

9.8.2 Afforestation Projects

9.8.2.1 General Provisions

1. Eligible forestry projects involving afforestation via plantings initiated on or after January 1, 1990, on forest land that had been degraded[7] or in unforested condition on December 31, 1989, may earn CCX CFI's.

2. Under this protocol, eligible forestation activities must involve afforestation and should not involve any harvesting, including thinning, during the contract period. Projects enrolled under this protocol and subsequently harvested must meet the protocol requirements for managed forests. Projects that do not remain enrolled in the program under the managed forest protocol must surrender all Carbon Financial Instruments accrued on that parcel.

3. CCX CFI's will be issued to owners of CCX-eligible afforestation projects on the basis of verified documentation reporting the annual increase in carbon stocks in live tree[8] and soil organic carbon[9] portion of the carbon pool forest (expressed in metric tons of carbon dioxide) on eligible sites included in the project during the years 2003 through 2010.

[7] Qualifications for degraded land will be determined by CCX Committee on Forestry on a case by case basis depending on the region and project attributes.

[8] Live trees, as defined in Table 1.1 of the DOE 1605b report, refers to: "Live trees with diameter at breast height (d.b.h.) of at least 2.5 cm (1 inch), including carbon mass of coarse roots (greater than 0.2 to 0.5 cm, published distinctions between fine and coarse roots are not always clear), stems, branches, and foliage."

[9] Soil organic carbon, as defined in Table 1.1 of the DOE 1605b report, refers to: "Belowground carbon without coarse roots, but including fine roots and all other organic carbon not included in other pools, to a depth of 1 meter."

4. All issuance of Exchange forestry offsets to CCX-eligible afforestation projects shall require the placement of 20% of earned Exchange Forestry Offsets in a Forest Carbon Reserve Pool. A Forest Carbon Reserve Pool will be established for the entire pool of projects represented by each offset provider and aggregator. Exchange Forestry Offsets held in a Forest Carbon Reserve Pool shall remain the property of the Project Owner, and all Exchange Forestry Offsets not terminated by CCX shall be released to the Project Owner near the end of the market period.

5. Upon registration of the afforestation project with CCX, the Offset Provider or Offset Aggregator must present to CCX an attestation that the carbon stocks in forest parcels included in a project will be subject to long-term maintenance. This includes a contractual agreement between the aggregator and each participating landowner to maintain the enrolled land as forest for at least 15 years from enrolled date and a signed letter of intent from each registered landowner. This contract and letter will be included in the project filing. A sample letter of intent is included as Appendix 9.2Aiii.

6. Annual carbon accumulation in afforestation projects in the U.S. may be quantified using the CCX Carbon Accumulation tables. Similar tables may be developed by CCX for other regions in the world. Entities that elect to use other quantification methods for afforestation projects must have the methodology approved by the CCX Forestry Committee.

7. The quantification of changes in carbon stocks will be adjusted to reflect acquisition or disposition of forested land on an annual basis as outlined below:

    a. When forested land is acquired, the enrolled landowner may include eligible forest carbon accumulation provided that it meets all of the criteria set forth in this section.

    b. If forested land is disposed by a land owner, then the offset provider or aggregator must return to CCX, for retirement, the quantity of offsets issued to the project for sequestrated carbon for entire length of time that the land has been enrolled in the program.

        i. However, disposed land from one pooled participant to another pooled participant that is also enrolled within CCX will be required to transfer CFI's to the other pooled participant. This may require transferring CFI's from one aggregator to another.

8. All enrolled land is subject to third party verification requirements by CCX-approved verifiers. Guidelines for verification are outlined below.

9.8.2.2 Project Registration Filings

Project Registration Filings must document project acreage, description of planted tree species and the tree ages, sizes, and planting density at the time of the Project Registration.

CCX will provide Forestry Project Registration documents, which shall include:

1. Description of afforestation activity;
2. Evidence that planting occurred after December 31, 1989;
3. Description of pre-Project condition of included lands;
4. Legal description of land included in the forest Project;
5. Identity of the land owner(s);
6. Legal evidence that the Project land is owned by the Project Owner, or, in instances where the Project owner is not the landowner, evidence that the CCX Forestry offsets to be generated by the Project are legally owned by the Project Owner;
7. Documentary contractual evidence between the aggregator and landowner that Project lands will remain as forest stock for at least 15 years;
8. Letter of intent from landowner to maintain forests beyond length of the CCX market period.

9.8.2.3 Included Carbon Pools

CCX CFIs will be issued on the basis of increases in carbon stocks in live tree and soil organic carbon portions of enrolled project lands. In addition to the CCX-prescribed terms and conditions, in all cases forest owners (or, as applicable, the ultimate owner of carbon sequestration rights associated with land included in a CCX Project) shall retain ownership rights for all sequestration occurring in any excluded carbon pools.

If an enrolled forest owner does not conform to the CCX Afforestation Offset performance rules, such event shall be promptly reported to CCX (such reporting shall occur through a project's aggregator if the project is registered through an aggregator). CCX will then cancel CFI's in an amount equal to the quantity of forest offsets previously issued to the project. The owner of the non-performing forest project shall be prohibited from further participation in CCX.

9.8.2.4 Forest Carbon Quantification Methods

U.S. based Afforestation Projects may quantify carbon sequestered in eligible forests through use of the CCX Carbon Accumulation tables. Similar tables may be developed for other regions of the world. The tables are presented in Appendix 9.2Ai.

9.8.2.5 Treatment of Catastrophic Losses and Forest Carbon Reserve Pool

Each CCX afforestation project (which can be an aggregated pool of forest projects) shall be required to place 20% of the offsets it earns into a CCX Forest Carbon Reserve Pool. Such offsets shall remain the property of the forest owner(s) (pool participants in the case of aggregated projects) and all forest offsets that remain in the Forest Carbon Reserve Pool shall be released to forest owners near the end of the market period.

CFIs in the Forest Carbon Reserve Pool will be used to compensate for any catastrophic losses. The maximum amount of such carbon loss to be recognized by CCX for catastrophic losses shall be no more than the total quantity of forest offsets available in the Forest Carbon Reserve Pool after the of annual verification.

9.8.2.6 CCX Forest Offset Aggregators

An aggregator is a CCX-registered entity that serves as an administrative representative, on behalf of Project Owners, of multiple Forest Projects. Projects that are represented in CCX by an aggregator are referred to as “pooled projects”. The “pool” refers to the multiple projects represented by the aggregator.

Each aggregator is assigned a CCX Registry Account which will hold all offsets issued to Projects it represents. Aggregators shall also be Authorized Traders in the CCX Trading Platform for such offsets. Aggregators shall be responsible for receiving from individual projects the CCX-required project reports, and for submitting to CCX summary reports of projects they represent. Necessary forms will be provided by CCX. The terms of the business and legal relationships between aggregators and Forest Owners are left to the discretion of those parties.

In addition to the terms and conditions presented in the CCX Rulebook Chapter on Offsets, the terms and conditions of provided in the following shall apply to CCX Exchange Forestry Offset Projects that are aggregated.

1. The aggregator acknowledges that it must annually submit a signed attestation that it is in conformance with the terms and conditions presented herein to CCX.

2. The aggregator acknowledges that actual increases and decreases in forest carbon stocks must be reported to CCX in accordance with CCX rules.

3. The aggregator acknowledges that a CCX-approved verifier must be selected to provide verification of the project, and be allowed access to forest lands and project documents for the purpose of undertaking project verification.

4. The aggregator acknowledges that a decrease in carbon stocks will result in cancellation of CFI's held in the Forest Carbon Reserve Pool. The aggregator is responsible for replenishing, within one year of cancellation, cancelled CFI's in the Forest Carbon Reserve Pool to maintain a 20% escrow. The aggregator may be required to surrender additional Carbon Financial Instruments to compensate for loss of carbon stocks if the quantity of forest offsets in the Reserve Pool is inadequate.

5. Aggregators are responsible for maintaining and available for verification, a sound database and monitoring management system capable of tracking each individual owner's forest land holding enrolled in the program. CCX will provide guidelines for the data that needs to be maintained by aggregators for enrolled forestry offset projects.

9.8.2.7 Guidelines for Verification on Afforestation Offset Projects

Objective and Scope of Work

Desk and field verification of CCX Afforestation projects on registered projects in the CCX Offset program must be conducted by a CCX approved verifier. Verification is intended to confirm the reported species mix and characteristics, verify acreage enrolled in program, confirm that forest management practices on enrolled land are in conformance with the program criteria, and to identify any acres not in compliance with eligibility criteria. Verification costs are borne by the project provider/aggregator.

Desk Review

All land enrolled by the selected applicant or forest offset provider are subject to an annual desk audit. Landowners that are unable to provide sufficient documentation will be ineligible. A checklist list of verification requirements is contained in Appendix 9.2Aii.

Field Verification

Field verification consists of inspecting at least 10% of both the participants and acreage enrolled in the program. This field inspection will occur when the project is approved, at the end of the CCX commitment period, and, subject to the recommendation of the CCX Committee on Forestry, for additional periods. The projects selected for field verification are chosen at the discretion of the verifier. Land will be inspected to confirm the appropriate use of the approved quantification method, species mix and age class, ownership, and the number of eligible acres. The field verification shall provide an opinion that the practices and requirements provided in the CCX project proposal have been implemented as intended.

Statement of Intent

Each project owner must sign a statement of intent declaring that the applicant intends to respect and abide by the protocol developed by CCX on all land enrolled in the program and that the applicant intends to preserve the Forest Stocks beyond December 31, 2010. A copy of the letter is included in Appendix 9.2Aiii.

State Programs

The CCX Committee on Forestry will review state forest programs that involve monitoring on a case-by-case basis to determine if the verification process associated with state programs could act as a substitute for CCX field verification.

9.8.3 Long Lived Wood Products

9.8.3.1 General Provisions

1. CCX forest offset providers/aggregators must register net forest carbon stock changes from growth that is quantified using the Model-based accounting approach described in the managed forest offset protocol.

2. All claimed long-lived wood products must be produced on sustainably managed forests as evidenced by certification from agencies or schemes that have been endorsed by the PEFC[10] or other certification programs approved by CCX Committee on Forestry. Approved certification schemes are included as Appendix 9.2Ci.

3. The quantity of long-lived wood products to be included will be the fraction of carbon in long-lived wood products in use and landfills at the end of 100 years based on the Department of Energy 1605b technical guidelines for forestry. The wood product conversion factors will be based on prescribed default wood category utilization coefficients presented in the CCX calculator for participant members. These conversion factors by wood product categories are presented in Appendix 9.2Cii, 9.2Ciii, and 9.2Civ.

4. The forest offset provider/aggregator must provide, on an annual basis, third party verified information documenting the quantity of wood products harvested by category, species and region.

[10] The PEFC Council (Programme for the Endorsement of Forest Certification schemes) is an independent, non-profit, non-governmental organization, founded in 1999 which promotes sustainably managed forests through independent third party certification. The PEFC provides an assurance mechanism to purchasers of wood and paper products that they are promoting the sustainable management of forests.

5. CCX aggregators who register wood products carbon are responsible for maintaining a sound database and monitoring management system capable of tracking annually each individual owner's forest land holding enrolled in the program, records of management activity, and any sales of harvested wood. All of these records must be available for audit. CCX will provide guidelines for the data that needs to be maintained by aggregators for enrolled small forestry offset projects.

6. CCX aggregators must establish contractual agreements with CCX-enrolled forest land owners that provide that carbon rights from long-lived wood products will be exclusively traded through the respective aggregator. Landowners must also establish exclusive contractual rights with the primary wood products manufacturer to the carbon rights associated with long-lived wood products. Any violation of program rules should be promptly reported to the Exchange. The CCX Committee on Forestry may prescribe additional measures to ensure that no double counting of carbon rights from carbon registered by enrolled participants is carried out.

7. Timber purchasers may acquire these rights from landowners provided that this can be documented according to chain of custody documentation outlined in this document. Long lived wood products carbon rights cannot be transferred beyond the primary wood products manufacturer at this time.

9.8.3.2 Quantification

Participant members electing to quantify and report carbon sequestration in long-lived wood products need to report harvest quantity by CCX recognized wood product categories. CCX CFIs will be issued for the calendar year based on the fraction of carbon in long-lived wood products in use and landfills after 100 years from the harvest wood.

Recognized wood product categories include

1. Softwood saw timber
2. Softwood pulpwood
3. Hardwood saw timber
4. Harwood pulpwood

Forest offset providers must use the DOE product-based estimates for estimating long lived wood products carbon. These estimates use the harvest volume of wood available for subsequent processing as the starting point for estimating carbon in long lived wood products. The main variables required for the estimation is independently verified measure merchantable wood under CCX-recognized wood product categories. Verification requirements may involve audit of sales receipts from the enrolled forest landowner. The receipts must specify the wood products categories (softwood saw log, softwood pulpwood, hardwood saw logs and hardwood pulpwood) being sold.

Using above procedures outlined in the DOE 1605b technical guidelines for forestry, CCX has developed factors that convert the volume of harvested wood by category, to long-lived carbon in use and landfills at the end of 100 years across wood categories. These factors are presented in Appendix 9.2Cii, 9.2Ciii, and 9.2Civ..

The quantity of carbon dioxide in long lived wood products at the end of 100 years is computed using the following formula:

$$Carbon\_Products_{R} = \sum_{C} Wood\ Product\ Category_{R,C} * Harvest\ Volume_{R,C}$$

Where
R = Region
C = Wood product category (Softwood saw log; Softwood pulpwood, Hardwood saw log and Hardwood pulpwood)

Carbon in use and landfills after 100 years in long-lived wood products for participant members is determined as follows:

1. If the harvest is reported in volume, the harvest must be converted into weight using conversion factors reported in the appendix.

2. If the harvest is reported in weight, determine the dry tons of carbon in CCX recognized wood product categories. This process involves converting green tons of harvested wood to dry tons across CCX wood product categories using a factor of 0.5 and converting dry tons across wood product categories to carbon tons using a factor of 0.5.

3. Distribute carbon tons by wood product category.

4. Use CCX prescribed conversion factors to calculate the quantity in use and landfills after 100 years by wood product category.

5. Convert to metric tons of carbon dioxide. This is done by multiplying by 3.67 to convert from carbon to carbon dioxide and then by 0.907 to convert to metric tons.

9.8.3.2.1 Hypothetical Example 1 – Harvest Reported in Weight

Consider a harvest in the North East produced 4,000 tons green weight of round wood. Further assume that the harvest was distributed across wood product categories in following fashion:

1. Softwood saw timber: 7.9%
2. Softwood pulpwood: 5.1%
3. Hardwood saw timber: 46.5%
4. Harwood pulpwood: 40.5%

The 100 year in-use carbon dioxide in long-lived wood products (expressed in metric tons) is determined as follows.

Step 1: Convert green weight of roundwood to dry tons: (4000 green tons * 0.5 (green tons / dry tons)) = 2,000 dry tons

Step 2: Convert dry tons to carbon tons: (2,000 dry tons * 0.5 (dry tons / carbon tons)) = 1,000 carbon tons

Step 3: Distribute carbon tons across categories:

1. Softwood saw timber: 79 carbon tons
2. Softwood pulpwood: 51 carbon tons
3. Hardwood saw timber: 465 carbon tons
4. Harwood pulpwood: 405 carbon tons

Step 4: Estimate 100 year in use value by wood product category

1. Softwood saw timber: 79 tons of carbon * 0.318 = 25.122 tons
2. Softwood pulpwood: 51 tons of carbon * 0.090 = 4.59 tons
3. Hardwood saw timber: 465 tons of carbon * 0.316 = 146.94 tons
4. Harwood pulpwood: 405 tons of carbon * 0.261 = 105.705 tons

Total = 282.357 tons of carbon

Step 5: Convert to metric tons of Carbon dioxide:

(282.357 *3.67*0.907)= 939.88 metric tons of CO_2

9.8.3.2.2 Hypothetical Example 2 – Harvest Reported in Volume

Consider a harvest of maple-beech-birch forest in the Northeast that produced 200 MBF of hardwood sawtimber and 1,000 cords of hardwood pulpwood.

Step 1: Convert volumes to common unit (thousand cubic feet):
Sawtimber: 200 MBF * 0.146 = 29.2 MCF
Pulpwood: 1,000 cords * 0.075 = 75 MCF

Step 2: Convert volumes to metric tons of carbon:
Sawtimber: 29.2 MCF * 18.96 lb c/cu ft) = 553.6 thousand pounds
553.6 thousand pounds / 2.204 = 251.2 metric tons carbon
Pulpwood: (75 * 18.96) / 2.204 = 645.2 metric tons carbon

Step 3: Estimate 100 year in-use value by wood product category
Sawtimber: 251.2 * 0.316 = 79 metric tons
Pulpwood: 645.2 * 0.261 = 168 metric tons

Step 4: Convert to metric tons of carbon dioxide equivalent
(79 + 168) * 3.67 = 909 metric tons of carbon dioxide equivalent

9.8.4 Managed Forest Projects

9.8.4.1 General Provisions

1. Project owners and aggregators must provide evidence of sustainable forest management of all their managed forest land through certification from agencies or schemes that have been endorsed by the PEFC[11] (e.g. SFI), the Forest Stewardship Council, or other certification programs approved by the CCX Committee on Forestry. A complete list of CCX approved certification schemes is available in Appendix 9.2Ci. Carbon Financial Instruments may be issued retroactively prior to obtaining certification for sustainable management provided that sustainable certification exists when the project enrolls in CCX.

2. Project owners and aggregators may earn Exchange Forestry Offsets issued for managed forest projects on the basis of verified documentation for the net changes in carbon stocks (expressed in metric tons of carbon dioxide) on eligible sites included in the project during each of the years 2003 through 2010. The net change in carbon stocks is defined by the equation:

   Net change in Carbon Stocks = (increases in Carbon Stocks due to growth) minus (the quantity by which Carbon Stocks decreased due to harvest, pest, fire and adverse weather events).

   If an offset provider or aggregator reports for the calendar year a net decrease in Carbon Stocks from the previous calendar year, the project owner or aggregator must Surrender Carbon Financial Instruments in an amount reflecting net decreases in Carbon Stocks from the previous year. Offset providers or aggregators may use banked allowances for compliance in this situation.

[11] The PEFC Council (Programme for the Endorsement of Forest Certification schemes) is an independent, non-profit, non-governmental organization, founded in 1999 which promotes sustainably managed forests through independent third party certification. The PEFC provides an assurance mechanism to purchasers of wood and paper products that they are promoting the sustainable management of forests.

3. Quantification of net changes in forest carbon stock must involve a timber inventory and growth-and-yield modeling approach. Managed forest projects will be issued or debited CCX CFIs on the basis of net annual change in forest carbon stocks through the CCX Market Period (2003-2010). Growth and yield Model estimates of net annual changes in carbon from forestry project will be discounted to account for variance in model estimates by the minimum of 20% or two times the reported statistical error[12] associated with a 90% confidence interval of the baseline inventory data.

   All managed forest projects are subject to approval of the CCX Committee on Forestry. No discount will be applied for instances when in-field inventories are conducted on an annual basis. Post-harvest cruises must be conducted for a particular landowner subsequent to a significant harvest or thinning.

4. All issuance of Exchange Forestry Offsets to CCX-eligible forestry projects, including managed forestry projects, shall require the placement of 20% of earned Exchange Forestry Offsets in a Forest Carbon Reserve Pool. A Forest Carbon Reserve Pool will be established for the entire pool of Projects represented by each offset provider and aggregator. Exchange Forestry Offsets held in a Forest Carbon Reserve Pool shall remain the property of the Project Owner, and all Exchange Forestry Offsets not terminated by CCX (in the event of a catastrophic loss) shall be released to the Project Owner during 2010. Should CCX extend beyond 2010, the Forest Carbon Reserve Pool will be maintained for projects that elect to remain enrolled in CCX.

5. Upon registration, Forest Offset Providers or Offset Aggregators must present to CCX an attestation that the carbon stocks in the managed forest project will be subject to long-term maintenance in a manner deemed acceptable by the CCX Forestry Committee. This includes a contractual agreement between the aggregator and each participating landowner to maintain the enrolled land in an approved sustainable certification program for at least 15 years from enrolled date and a signed letter of intent from each registered landowner. This contract and letter will be included in the project filing.

6. The quantification of changes in carbon stocks will be adjusted to reflect acquisition or disposition of forest land on an annual basis as outlined below:

   a. When forested land is acquired, the enrolled landowner may include eligible forest carbon accumulation provided that it meets all of the criteria set forth in this document. When forest parcels are purchased, the carbon stocks on the purchased forest are not counted as growth for the year they are purchased, but are added into the baseline so that the net growth may be calculated in the subsequent year.

[12] The statistical error (E) is defined as the difference between the mean carbon sequestration (X) and the lower confidence limit value (LCL) divided by the mean carbon sequestration (X). Thus, E=[(X-LCL)/X].

b. If forested land is disposed by a land owner, then the offset provider or aggregator will be penalized by the total amount of offsets issued by CCX for sequestrated carbon from those acres for entire length of time that the land has been enrolled in the program.

   The offset provider or aggregator will not be required to surrender accrued CFIs on the disposed land if the purchaser of the land:

   i. Enrolls the purchased land in CCX under CCX criteria. Under such conditions, a transfer of credits from one aggregator to another may be required.

   ii. Does not enroll the purchased land in CCX, but;

      1. maintains certification for sustainable management on the purchased land under a CCX-approved sustainability standard through the CCX commitment period; and satisfies **one** of the following criteria:

      2. signs an attestation that carbon stocks are nondecreasing on this parcel from the time of purchase through the end of the CCX Market Period

      3. the Member is able to verify through remote sensing techniques that carbon stocks on the purchased land are nondecreasing on this parcel from the time of purchase through the end of the CCX Market Period

      4. the Forestry Committee may consider acceptable alternatives to 2) and 3) on a case-by-case basis. Acceptable alternatives may include requiring a percentage of the accrued CFI's to be surrendered.

   CCX does not require the member to return the accrued CFIs provided that the above conditions are met on an annual basis. If the requirements are not met at any remaining point in the CCX market period, then the member is responsible for surrendering the accrued CFIs.

7. Forest offset aggregators are responsible to maintain a database of pooled participant records, maintain accurate records of enrolled project forest inventories, and keep track of management activities in enrolled forest lands. The database records, model inputs and all enrolled land are subject to third party verification requirements by CCX-approved verifiers.

8. If an enrolled participant's project land does not conform to the managed forest offset performance requirements, such event shall be promptly reported to CCX (such reporting shall occur through a project's aggregator if the project is registered through an aggregator). CCX will then cancel all CCX CFI's in an amount equal to the quantity of forest offsets previously issued to the project. The owner of the non conforming forest project shall be prohibited from further participation in CCX.

9.8.4.2 Baseline

Project participants must establish a baseline of forest carbon stocks for purposes of calculating net changes in forest carbon stocks and subsequent issuance of CFIs. Once established, this baseline will serve as the reference year for all purposes in the managed forest project pool during the CCX market period. The baseline is established as the biomass level in the enrolled parcels on December 31 of the year preceding their enrollment.

Participants are eligible to earn CFI's based on verified documentation of net changes in forest carbon stocks from the baseline year. Project proposal filing must present sufficient data on forest inventories and management activities on enrolled forest land while establishing the baseline. Baselines are subject to audit by a CCX approved verification agency.

9.8.4.3 Included Carbon Pools

Net changes in carbon stocks shall be quantified only on the basis of increases in above-ground and below ground living biomass occurring on lands included in the CCX project. The above-ground living biomass carbon pool includes stem wood, stem bark, and branches. The below-ground living biomass carbon pool includes coarse roots[13]. In addition to the terms and conditions established in this document, in all cases project owners (or, as applicable, the ultimate owner of carbons sequestration rights associated with forest land included in a CCX project) shall retain ownership rights for all sequestration occurring in any excluded carbon pools.

9.8.4.4 Forest Carbon Reserve Pool

Each CCX managed forest project (which could be an aggregated pool of forest projects) shall be required to place 20% of the offsets it earns into a CCX Forest Carbon Reserve Pool. Such offsets shall remain the property of the forest owner(s) (pool participants in the case of aggregated projects) and all forest offsets that remain in the Forest Carbon Reserve Pool shall be released to forest owners near the end of the market period.

[13] Acceptable methods for the inclusion of below-ground biomass in the United States are defined in Jenkins JC, Chojnacky DC, Heath LS, Birdsey RA (2003) National-Scale Biomass Estimators for United States Tree Species. Forest Science 49(1):12-35. Acceptable methods for the inclusion of below-ground biomass for regions outside of the United States are defined in Cairns M, Brown S, Helmer E, Baumgardner G (1997) Root Biomass Allocation in the World's Upland Forests. Oecologia 111: 1-11.

CCX CFI contracts in the Forest Carbon Reserve Pool will be used to compensate for any catastrophic losses. In cases of adverse weather events or outbreaks of fire and pest damage that do not reduce the quantity of Carbon Stocks on a parcel of forested land to levels below those documented for the baseline, the Member shall document the quantity of timber destroyed by the fire, pest or adverse weather event and Surrender an equivalent amount of Carbon Financial Instruments. The Member shall continue to quantify and report subsequent increases and decreases in carbon stocks on that land and shall be issued or must surrender Carbon Financial Instruments accordingly.

In cases of catastrophic weather events or outbreaks of fire and pest damage that reduce the quantity of carbon stocks on a parcel of forested land to levels below those documented for baseline, the Member shall document the quantity of timber destroyed by the fire, pest or adverse weather event. An amount of CFIs in the Forest Carbon Reserve Pool equal to the amount of the destroyed by the catastrophic event will be cancelled. The CFIs in the Forest Carbon Reserve Pool represent the maximum amount of CFIs that will be cancelled in the event of a catastrophic loss.

Those stands shall be excluded from future projections of annual changes in Carbon Stocks until the quantity of carbon stocks in those stands reaches the reported quantities for baseline. All reports of significant damage caused by pest, fire and adverse weather events shall be subject to audit by a CCX approved verification agency.

9.8.4.5 Managed Forest Project Proposals

All managed forestry project proposals must be submitted to the CCX Committee on Forestry for review and recommendation. Project proposal filing must contain the following information:

1. Organizational Description

   - Short description on the organization, its function and work related to forestation
   - Description of program goals, management etc
   - Program relationship between agency and landowners
   - Social impacts of forest land on indigenous community
   - Historical description of forest stands
   - Description of how initial baseline determined

2. Description of Forested areas

   - Species information
   - Planting dates
   - Acreage

- Legal ownership
- Maps and other pertinent information

3. Description of Forest Management Activity

- Harvesting cycle
- Description of thinning, clearing and other management activities
- End use of the wood

4. Quantification Model

- Brief description of the proposed quantification method
- Baseline measurement
  - Inventory frequency
  - Sampling techniques
  - Tree measurement techniques
  - Statistical precision
  - Backup equations
  - References and documentation

5. Description of Project and Proposed Aggregation Model

- Objectives of project
- Eligibility and landowner requirements
  - i. Sustainable Forest Management certification information
  - ii. Contractual requirements with aggregator
  - iii. Monitoring arrangement between aggregator and landowner
- Database description

9.8.4.6 CCX Forest Offset Aggregators

An aggregator is a CCX-registered entity that serves as an administrative representative, on behalf of Project Owners, of multiple CCX-qualifying Forest Projects. Projects that are represented in CCX by an aggregator are referred to as “pooled projects”. The “pool” simply refers to the multiple projects represented by the aggregator.

Each aggregator is assigned a CCX Registry Account which will hold all Offsets issued to Projects it represents. Aggregators shall also be Authorized Traders in the CCX Trading Platform for such offsets. Aggregators shall be responsible for receiving from individual projects the CCX-required project reports, and for submitting to CCX summary reports of projects they represent. A copy of this summary report is included as Appendix 9.2Di. The terms of the business and legal relationships between aggregators and Forest Owners are left to the discretion of those parties.

In addition to the terms and conditions presented in the CCX Rulebook Chapter on Offsets, the following terms and conditions shall apply to CCX Exchange Forestry Offset Projects that are aggregated.

6. The aggregator acknowledges that it must annually submit a signed attestation that it is in conformance with the terms and conditions presented herein to CCX.

7. The aggregator acknowledges that actual increases and decreases in forest carbon stocks must be reported to CCX in accordance with CCX rules.

8. The aggregator acknowledges that a CCX-approved verifier must be selected to provide verification of the project, and be allowed access to forest lands and project documents for the purpose of undertaking project audits.

9. The aggregator acknowledges that a decrease in carbon stocks due to catastrophic losses will result in cancellation of CCX CFI's held in the Forest Carbon Reserve Pool. The aggregator is responsible for replenishing cancelled CCX CFI's in the Forest Carbon Reserve Pool to maintain a 20% escrow within one year of cancellation. The aggregator may be required to surrender additional Carbon Financial Instruments to compensate for loss of carbon stocks if the quantity of forest offsets in the Reserve Pool is inadequate.

10. Aggregators are responsible for maintaining and available for audit, a sound database and monitoring management system capable of tracking each individual owner's forest land holding enrolled in the program at the stand level. A summary sheet outlining data requirements for each landowner is contained as Appendix 9.2Dii.

11. Aggregators must establish a baseline with each distinct pool of landowners that is enrolled. Quantification of baseline and net change in carbon stocks will be accounted separately for each project owner at the stand level within a registered pool of managed forest projects. On an annual basis, the baseline will be adjusted to reflect land acquisitions and dispositions within the enrolled pool.

9.8.4.7 Guidelines for Verification on Managed Forest Offset Projects

9.8.4.7.1 Objective and Scope of Work

Desk and field verification of CCX Managed Forest Offset projects on registered projects in the CCX Offset program must be conducted by a CCX approved verifier. Verification is intended to confirm the reported species mix and characteristics, verify acreage enrolled in program, confirm that forest management practices on enrolled land are in conformance with the program criteria, and to identify any acres not in compliance with eligibility criteria. Verification costs are borne by the project provider/aggregator.

9.8.4.7.2 Desk Review

All land enrolled by the selected applicant or forest offset provider are subject to an annual desk audit. Landowners that are unable to provide sufficient documentation will be ineligible. The desk audit must verify that the baseline and annual reports are in conformance with the managed forest offset protocol.

9.8.4.7.3 Field Verification

Field verification consists of inspecting at least 10% of both the participants and acreage enrolled in the program. This field inspection will occur when the project is approved, at the end of the CCX commitment period, and, subject to the recommendation of the CCX Committee on Forestry, for additional periods. The projects selected for field verification are chosen at the discretion of the verifier and will occur on land where harvesting has occurred whenever possible. Land will be inspected to confirm the appropriate use of the approved quantification method, species mix and age class, ownership, and the number of eligible acres. The field verification shall provide an opinion that the practices and requirements provided in the CCX project proposal have been implemented as intended.

9.8.4.7.4 Statement of Intent

Each project owner must sign a statement of intent declaring that the applicant intends to respect and abide by the protocol developed by CCX on all land enrolled in the program and that the applicant intends to preserve the Forest Stocks beyond December 31, 2010. A copy of the letter is included in Appendix 9.2Aiii.

9.8.5 Widely Spaced Tree Plantings

9.8.5.1 General Provisions

CCX Members and Participant Members may earn Carbon Financial Instruments for widely spaced tree planting projects initiated on or after January 1, 1990, on land not forested, or on land that had been degraded or unforested condition on December 31, 1989. The determination of density specifications for widely-spaced will be determined by the CCX Forestry Committee.

CCX aggregators must maintain a detailed database documenting planting dates and establishing that landowners with significant direct greenhouse gas emissions must be CCX Members in order to earn Carbon Financial Instruments for widely spaced tree planting projects. CCX aggregators must provide contractual evidence with each individual landowner regarding the permanence of maintaining the tree plantings into the future.

9.8.5.2 Quantification

The coefficients in Appendix Table 9.2B shall be applied for widely spaced tree planting Projects, including urban and suburban tree planting programs, undertaken in the U.S. and Canada. The CCX Forestry Committee may recommend modifications to the Tables provided in Appendix 9.2.

9.8.6 Combined Forestation and Forest Conservation Projects (2006)

9.8.6.1 General Provisions

Offsets will be issued to forest conservation portions of eligible Combined Forestation and Forest Conservation Projects (provided the two activities occur on contiguous sites unless approved otherwise by the CCX Offsets Committee) in an amount reflecting recent deforestation rates in the state in which the Project occurs. Qualifying locations are in specified states of Brazil and in other locations as may be approved by the CCX Offsets Committee. The Avoided Deforestation Rate (ADR) will be calculated on the basis of the actual annual deforestation rate during recent multi-year time periods in the state in which the Project is implemented. Exchange Offsets shall be issued on the basis of a 10% discount of the quantity of avoided carbon loss due to deforestation as calculated on the basis of definitions provided herein.

The baseline and annual carbon sequestration benefits of all Combined Forestation and Forest Conservation Projects must be quantified through use of CCX-approved recognized direct quantification methods. The Project Registration Filing and all Project Reports must be verified by a CCX-approved Verifier.

9.8.6.2 Quantification

Exchange Offsets will be issued on the basis of the annual avoided carbon loss (expressed in carbon dioxide equivalence) on eligible sites during the Phase I and Phase II Market Periods. Exchange Offsets for forest conservation can be issued in an amount up to (but shall not exceed) the quantity of Exchange Offsets issued in the same year to the Forestation component of a Combined Forestation and Forest Conservation Project.

Table 9.2 lists the states of Brazil in which Combined Forestation and Forest Conservation Projects are pre-qualified to register as XFO Projects in CCX, as well as the Avoided Deforestation Rate to be applied in quantifying avoided carbon loss and XFO Offset issuance.

<u>Table 9.2</u> States in Brazil in Which Combined Forestation and Forest Conservation Projects are Pre-Qualified as Eligible to Register as XFO Projects in CCX, Annual Avoided Deforestation Rates to be Applied in Quantifying Avoided Carbon Loss and XFO Offset Issuance[14]

State	Annual Avoided Deforestation Rate (ADR) (% of forest included in the CCX-registered Project Carbon Stock baseline)
Alagoas	0.70*
Bahia	0.70*
Ceará	0.70*
Espiríto Santo	1.09
Goiás	1.82
Mata Grosso do Sul	1.91
Minas Gerais	1.46
Paraíba	0.70*
Pernambuco	0.70*
Piauí	0.70*
Paraná	0.93
Rio de Janeiro	2.63
Rio Grande do Sul	1.08
Santa Catarina	0.73
Sergipe	0.70*
São Paulo	0.72

** represents an initial default value to be modified upon acquisition of additional information.*

Annual avoided carbon loss will be defined as the mathematical expression listed below.
Annual avoided carbon loss = maximum possible offset issuance[15]
= 0.90 x Annual deforestation rate x adjusted baseline (adjusted for earlier-year offset issuance)

Year 1 = B x ADR
Year 2 = B x ADR (1 - ADR)
Year 3 = B x ADR (1 - ADR – ADR^2)
Year 4 = B x ADR x (1 - ADR – ADR^2 – ADR^3)

[14] The data in Table 9-2 are based on information provided by: "Avaliação e Ações Prioritárias para a Conservação da Biodiversidade da Mata Atlântica e Campos Sulinos," a publication of the Brazilian Environment Ministry with participation of Conservation International of Brazil, SOS Mata Atlântica, Institute of Ecological Research, Biodiversity Foundation, the Secretary of the Environment for the State of Sao Paulo and the State Forestry Institute of Minas Gerais.
[15] Subject to the constraint that annual avoided deforestation Offsets cannot exceed the forestation Offsets component of a combined Project.

Where "B" is the baseline Carbon Stock multiplied by 0.90. The baseline carbon is the quantity of living biomass carbon on-site at the end of 2002, expressed in carbon dioxide equivalent. The multiplication by 0.90 reflects a 10% discount applied to the quantification of the baseline Carbon Stock. ADR is the value shown in column 2 of Table 9.2.

The annual modification of the B x ADR value reflects that annual downward adjustment in quantity of carbon that would have been exposed to deforestation in the "without Project" scenario.

9.9 Exchange Soil Offsets (XSOs) (U.S. and Canada) (2007)

Projects involving specified agricultural soil carbon sequestration activities in designated states, counties, provinces and parishes in the U.S. and Canada shall be eligible to earn XSOs subject to the provisions of this section.

9.9.1 Conservation Tillage (2007)

Projects involving specified agricultural soil carbon sequestration activities in designated states, counties, provinces and parishes in the U.S. and Canada shall be eligible to earn CCX Exchange Soil Offsets (XSOs) as per the rates provided in Appendix 9.3A. Eligible U.S. counties and states are provided in Appendix 9.3B.

Eligible conservation tillage practices vary by region and are broadly outlined by zones in the sections below. Practices and implements not specified below may be considered by CCX on case-by-case basis. CCX eligible practices generally follow the Natural Resources Conservation Service (NRCS) guidelines for conservation tillage[16]. While ridge till is included under the definition of conservation tillage provided by NRCS, it will not be eligible for Exchange Soil Offsets. As a general rule the tillage practice must leave at least two thirds of the soil surface undisturbed with at least two thirds of the residue remaining on the field surface.

9.9.2 Grassland Planting (2007)

[16] For CCX purposes Conservation Tillage is as defined in the Natural Resources Conservation Service National Handbook of Conservation Practices. These definitions are: No-till/Strip-till - Managing the amount, orientation, and distribution of crop and other plant residue on the surface year-round while growing crops in narrow slots or tilled or residue-free strips in soil previously untilled by full width inversion implement.

Projects involving specified agricultural soil carbon sequestration activities in designated states, counties, provinces and parishes in the U.S. and Canada shall be eligible to earn CCX Exchange Soil Offsets (XSOs) at the specified rates provided for regions listed in Appendix 9.3C. XSOs will be issued to land managers who commit to maintain increases in soil carbon stocks realized as a result of permanent grass cover plantings that were undertaken on or after January 1, 1999. Such grass cover must be maintained through 2010 on the acres specified upon project registration.

An Owner of an Exchange Soil Offset Project may be issued additional XSOs if the Owner presents evidence that actual increases in soil carbon exceed the rates stipulated above, provided such evidence is deemed acceptable by the CCX Offsets Committee.

9.9.3 Rangeland Management (2007)

Exchange Soil Offsets may be issued to land owners who commit to increase Carbon Stocks realized on managed rangelands in approved geographic areas. Eligible projects include:

a) Non-degraded rangeland managed to increase carbon sequestration through grazing land management that employs sustainable stocking rates, rotational grazing and seasonal use in eligible locations.

b) Restoration of previously degraded rangeland through adoption of sustainable stocking rates, rotational grazing and seasonal use grazing practices initiated on or after January 1, 1999.

Exchange Soil Offsets will be earned at a specified rate of metric tons CO_2 per acre per year in eligible geographic areas. Verification shall be conducted in accordance with provisions contained in Chapter 10 of the CCX Rulebook. Appendix 9.3D provides the protocol and standards for rangeland sequestration Exchange Soil Offsets[17].

9.9.3.1 Eligible Project locations, Offset Issuance Rates

Eligible rangeland soil carbon management Offset Issuance rates are based on below-ground carbon sequestration rates established for designated Land Resource Regions. Additional Land Resource Regions may be added to the regions listed in Appendix 9.3D. Issuance rates may also reflect the status of the land (degraded or non-degraded) prior to inception of project.

Eligible geographic areas are defined according to USDA Land Resource Region (LRR). Rangeland projects are also bounded by average annual precipitation levels for the specific

[17] Soil sequestration on Rangeland is acknowledged by CCX to be a complex and continually developing area. CCX may update protocols and/or expand eligible geographic areas as new studies and information become available.

region. Rangeland projects must take place in areas where long-term annual average precipitation is not less than 14” and not greater than 40”.

Rangeland Soil Carbon Management Offset Issuance rates are as follows (in metric tons CO2/acre/year):

Northwestern Wheat and Range Region (LRR B)

Sequestering practices on non-degraded managed rangeland	Restoration of degraded rangeland
0.12	0.20

California Subtropical Fruit, Truck, and Specialty Crop Region[18] (LRR C)

Sequestering practices on non-degraded managed rangeland	Restoration of degraded rangeland
0.16	0.16

Rocky Mountain Range and Forest Region (LRR E)

Sequestering practices on non-degraded managed rangeland	Restoration of degraded rangeland
0.12	0.28

Northern Great Plains Spring Wheat Region (LRR F)

Sequestering practices on non-degraded managed rangeland	Restoration of degraded rangeland
0.12	0.24

Western Great Plains Range and Irrigated Region (LRR G)

Sequestering practices on non-degraded managed rangeland	Restoration of degraded rangeland
0.27	0.40

Central Great Plains Winter Wheat and Range Region (LRR H)

Sequestering practices on non-degraded managed rangeland	Restoration of degraded rangeland
0.20	0.52

Provided the project owner is able to present documentation sufficient to allow independent verification that recognized grazing practices have taken place historically, qualifying lands and

[18] In this region, a key feature of the landscape is the Oak tree layer interspersed within rangelands. Research has shown that the native Oak trees have a positive impact on nutrient cycling, productivity and carbon storage in the soil system. Projects must have left the tree layer intact in order to qualify for Offsets.

practices may be issued CCX Rangeland Soil Carbon Management Offsets for the years 2003 and later.

9.9.4 Additional Regions for Exchange Soil Offsets (2007)

The CCX Offsets Committee may approve other regions of the U.S. and Canada as eligible for generation of Exchange Soil Offsets.

9.9.5 Soil Carbon Reserve Pool (2007)

Each CCX XSO Project shall be required to place 20% of the Offsets it earns into a CCX Soil Carbon Reserve Pool. Such XSOs shall remain the property of the Project Owner(s) (pool participants in the case of aggregated Projects) and all XSOs that remain in the Soil Carbon Reserve Pool for Phase I shall be released to Project Owners at a time that allows the owner to participate in trading before the True-up for the calendar year 2006. Offsets held in Soil Carbon Reserve Pool for Phase II shall be released to Project Owners at a time that allows the owner to participate in trading before the True-up for the calendar year 2010. In the event that a Project Owner does not conform to the XSO performance requirements listed above, such event shall be promptly reported to CCX (such reporting shall occur through a Project's Aggregator if the Project is registered through a CCX Offset Aggregator). CCX will then cancel XSOs held in the Soil Carbon Reserve Pool in an amount equal to the quantity of XSOs previously issued to the Project.

Project Owners may be responsible for replenishing the Soil Carbon Reserve Pool by replacing the XSOs that are cancelled in instances of Project non-performance. Each previously issued XSO must be replaced with one CCX Exchange Allowance or Exchange Offset.

In the case of noncompliance with the terms and conditions for CCX Exchange Soil Offsets the owner of the noncompliant Project shall transfer to the Soil Carbon Reserve Pool (as specified below) a quantity of CCX Exchange Offsets and/or Exchange Allowances that is equal to the total quantity of XSOs that have been issued to the Project during the Phase I and Phase II Market Periods. The Owner of the non-performing Project shall be prohibited from further participation in CCX.

9.9.6 Verification

Unless specified otherwise, verification entities designated by CCX shall conduct in-field inspections of enrolled XSO Projects. Such inspections shall examine field conditions, documentation of Project start dates (when applicable) and other records as may be specified by CCX.

9.10 Exchange Emission Reductions (XERs) (2007)

Exchange Emission Reductions are CCX Exchange Offsets that are issued to owners of the rights to Greenhouse Gas mitigation produced by qualifying Projects undertaken in developing countries. XERs are eligible for Compliance in CCX.

Qualifying XER Projects will include:

(a) fuel switching,
(b) renewable energy generation from solar, wind, and biomass systems and,
(c) heat recovery and energy efficiency projects that displace fossil fuel.

CCX Offsets Committee shall consider such projects on a case-by-case basis.

9.11 Exchange Early Action Credits (XEs) (2006)

Exchange Early Action Credits (XEs) will be issued to certain Projects undertaken from 1995 through 1998. To qualify, a Project must be:

(1) off-system; or an Owned and Operated project;
(2) originally undertaken or financed by CCX Members;
(3) direct emission reductions or involve sequestration;
(4) legally owned by the CCX Member;
(5) measured and verified; and,
(6) registered in the U.S. Department of Energy 1605(b) database, the U.S. Initiative on Joint Implementation program, or an equivalent registry system.

Unless specifically approved by the CCX Offset Committee, XEs can only be used for Compliance by the CCX Member that originally owned them. XEs are not transferable among Registry Account Holders, unless authorized by CCX.

Exchange Early Action Credits will be given to the following Project types that meet the eligibility criteria:

(i) reforestation, afforestation and avoided deforestation;
(ii) methane destruction in the U.S.; or,
(iii) fuel switching and other energy related United States Initiative on Joint Implementation (USIJI) Projects.

Exchange Early Action Credits will be issued on the basis of mitigation tonnage realized by the qualifying Project during the years 1995 through 2010. Applicable verification requirements shall be the same as those required for comparable Offset Project types.

9.12 CCX Offset Issuance for Electricity Produced by Renewable Energy (8/12/2005)

9.12.1 General Provision

In reflection of CO_2 emissions displacement, CCX Offsets will be issued to legal owners of offsets produced by eligible renewable energy facilities on the basis of electricity produced by such facilities.

9.12.2 Eligible Entities

The entity types eligible to earn CCX Offsets from renewable energy facilities are defined as entities that undertake sales of electricity produced by renewable energy systems to entities that are not engaged in production and sale of electricity.[19]

9.12.3 Facilities Eligible to Produce Offsets (2008)

Offsets may be generated by eligible renewable energy facilities owned by an Eligible Entity and placed into service on or after January 1, 1999.

As provided in Section 4.10.1, eligible facility types shall be electricity generation systems associated with CCX recognized renewable energy sources, which are:

- Solar;
- Wind;
- renewable fuels, which, for CCX purposes are;
    - wood, wood waste and wood-derived fuels
    - agricultural residues and grasses
    - landfill, agricultural and coal mine methane,
    - ethanol (bioalcohol).

9.12.3.1 Facilities Using Renewable Fuels

Offsets produced by eligible facilities using renewable fuel along with, or in place of, non-renewable fuel shall determine the amount of eligible offsets based on emissions displaced. Displaced emissions are those that would have otherwise been emitted if the equivalent energy content of non-renewable fuel was used instead of renewable fuel. Therefore, displaced emissions are calculated by multiplying the annual heat input of the renewable fuel by the emission rate per unit of energy of the non-renewable fuel. (Calculation assumes all renewable fuels are considered CO_2 neutral).

[19] As provided in Section 9.1, CCX will not accept registration of Offsets or Offset Projects that are owned (in full or partially) by an entity that is eligible to be a CCX Member but is not a Member. This prohibition also extends to entities that may have no direct ownership but have a beneficial interest in such Offset Project(s)

9.12.4 Required Energy Contract Conditions

CCX Offsets for electricity produced by eligible renewable energy facilities can be issued only if the owner of the facility conforms with all of the following requirements:

1. The entity that operates the facility producing the proposed offsets must establish in its power purchase agreement contracts that it retains all green attributes associated with the electric power generated.
2. The entity that operates the facility producing the proposed offsets must not sell its generated electricity as "green power" or allow other entities that may resell such electricity to make such claim.
3. If power production by the facility that produces the proposed offsets yields Renewable Energy Certificates (RECs), those RECS must be surrendered to and retired by CCX in order to allow issuance of Offsets.
4. The renewable energy facility producing the proposed offsets is not counted towards meeting obligations established by state or local renewable energy mandates.

The CCX Offsets Committee shall review all proposed renewable energy-based offsets. Such reviews will include an assessment of the four conditions cited above as well as any other circumstances that could result in double-counting of emission reductions associated with the proposed offsets. The entity proposing registration of renewable energy-based offsets shall provide information requested by the Offsets Committee as it undertakes such reviews.

9.12.5 Offset Issuance Rate (2007)

CCX Offsets will be issued at a rate of metric tons CO_2 per megawatt-hour generated by eligible renewable energy facilities as determined by region specific values of the U.S. EPA's Emissions and Generation Resource Integrated Database (eGRID) tool.

9.13 CCX Offset Issuance for Destruction of Ozone Depleting Substances (2007)

9.13.1 General Provision

In reflection of the destruction of ozone depleting substances (ODS), CCX Offsets will be issued to CCX members who undertake the destruction of certain ODS.

9.13.2 Eligible Entities

Eligible entities are those that facilitate the destruction of selected ODS at a facility that meets all Clean Air Act Amendments (CAAA) and Resource Conservation and Recovery Act regulatory requirements. Entities and facilities that destroy imported ODS must demonstrate that the material was imported into the U.S. in accordance with CAAA requirements.

CCX eligibility requirements for issuing offset for ODS destruction as Exchange Fluorocarbon Destruction Offsets (XFDOs) are as follows:

- CFCs, halons, carbon tetrachloride, methyl chloroform, hydrobromofluorocarbons, and HCFC-141b destroyed on or after January 1, 2007 can be registered and traded on the CCX.

In order for a project to be deemed eligible, the project activity cannot be undertaken to come into compliance with existing or imminent legislation. As of July 2007, ODS destruction would exceed federal, state, and/or local requirements governing GHG emissions, therefore, any destruction project involving ODS that has been phased out of production will be considered eligible. However, because new regulations may be implemented in the future, CCX members must demonstrate that federal, state and/or local regulations do not require ODS destruction when implementing specific, individual projects.

9.13.5 Offset Issuance Rate

Offsets shall be issued on the basis of the global warming potential of the ODS destroyed less 25%. Appendix 9.4 provides the protocol to be employed in quantifying ODS destruction for CCX XFDO Projects.

APPENDICES

TO

CHAPTER 9

Appendix 9.1A Protocol for Measuring and Verifying Greenhouse Gas Reductions from Landfills (1/21/2004)

INTRODUCTION

The purpose of this protocol is to address the measurement and verification of methane emissions reductions from the combustion of landfill gas (LFG) for the Chicago Climate Exchange (CCX).

Topics covered in this document include the following:

- Overview of requirements and overall approach for crediting methane reductions from landfills as emission offsets;
- Protocol for measuring, recording, and verifying methane recovery rates based on LFG flow and methane measurements;
- Use of measured data to calculate methane emission reductions at non-regulated sites;
- An alternative method for calculating methane emission reductions at LFG-to-energy facilities;
- Protocol to distinguish methane recovery resulting from early system installation vs. methane recovery from systems installed to meet regulatory requirements; and

Topics not included in this document include the following:

- Accounting for (carbon dioxide) emission reductions that may result from displacement of other fuels used in power production;
- Protocol for offsets for expanded LFG recovery from regulated sites other than from accelerated recovery (i.e., before required by regulation) from new cells;
- Accounting for effects of oxidation when calculating methane emissions reduction; and
- Protocol for offsets from other measures to reduce methane emissions through enhanced recovery or oxidation, including: 1) Geomembranes; 2) Bio-covers; and 3) Bioreactors.
- Third party verification requirements. Verification shall be conducted in accordance with the provisions contained in Chapter 10 of the CCX Rulebook and as prescribed by the CCX Offsets Committee.

Requirements and Overall Approach for Crediting Methane Reductions

For CCX purposes landfills are treated as providers of emission Offsets. CCX eligibility requirements for methane reductions from landfills are provided in Chapter 9 of the CCX

Rulebook. That Chapter also addresses Offset issuance rates for methane capture and combustion systems.

Landfill methane collection and combustion systems in the U.S. may be registered with CCX and may earn XMOs only for mitigation occurring during the time periods for which the landfill was not required to control LFG emissions (which is most commonly undertaken through methane collection and combustion systems) in accordance with U.S. regulations. The most commonly applicable regulations for U.S. landfills are the rules governing control of New Source Performance Standards (NSPS) rules (40 CFR Subpart WWW), which define if, when and how a gas collection and control system (GCCS) is required and how much non methane organic compounds (NMOC) must be controlled. The NSPS rules apply to landfills with design capacities greater than 2.5 million megagrams (2.75 million tons) that began receiving waste or commenced construction, reconstruction, or modification on or after May 30, 1991. These landfills are known as "new sources." Landfills above the 2.5 million megagram design capacity threshold that operated between November 8, 1987 and May 30, 1991, or have capacity available for future waste deposition, are considered "existing sources" and are regulated under the Emissions Guidelines (EG) rule. The EG rule has the same requirements as the NSPS rule for control of LFG emissions. These rules require a landfill to control emissions of non-methane organic compounds (NMOCs), a class of air pollutants present in LFG, when the estimated NMOC emissions exceed 50 megagrams or 55 tons per year. A GCCS must be installed to control NMOC emissions within 30 months of the time the landfill reports that its NMOC emissions exceed the 50 megagram threshold.

The NSPS rule also defines how quickly the GCCS needs to be expanded to incorporate recently deposited waste. The landfill must install wells in new waste cells and extract and control the NMOCs present in the LFG within 5 years of the time waste is first placed in the cell if the cell is still active, or within 2 years of the time waste is first placed in the cell if the cell is closed or at final grade.

While the NSPS rule provides clear definitions of the timing of required GCCS installations and expansions into new cells, there is no clear definition of what constitutes an NSPS-compliant system. The rule only specifies that the GCCS must be able to handle maximum expected flows from the entire landfill, and to minimize off-site subsurface migration or surface emissions. Additional extraction wells must be installed in areas of the landfill where monitored methane concentrations near the landfill surface exceed 500 parts per million (ppm) over a specified period of time. However, there does not appear to be a correlation between the number of 500 ppm exceedances and the ability of the GCCS to recover generated LFG.[20]

Accordingly, this protocol includes methods to distinguish methane emissions reduction resulting from early system installations (i.e., prior to the date required by NSPS), either in the case of new system installations or in the case of expansion of the system into new refuse cells. However, this protocol does not include methods for determining methane emissions reductions

[20]See Pierce, J.L. and Stege, A., 2002. Measurement and characterization of landfill gas surface emissions at landfills with soil covers. WasteCon, October 2002.

resulting from improvements to GCCSs beyond what is required by NSPS or other regulations, nor does it include methods for estimating methane emissions reductions from the installation of geo-membranes, biocovers, or bioreactors. The lack of those procedures in this protocol does not preclude later consideration of such methods.

The overall approach to quantifying methane emissions reductions described in this report is to rely on measured quantities of methane collected and destroyed through the operation of a GCCS. Direct measurement by continuous monitoring of methane recovery is the most desirable method. Periodic measurement of methane concentrations in LFG, coupled with continuous monitoring of LFG flows is considered acceptable. Details on acceptable methods for recording rates of methane emissions reduction from both non-regulated and regulated sites are provided in the remainder of this protocol.

PROTOCOL FOR RECORDING METHANE EMISSIONS REDUCTIONS

Rates of methane capture and destruction at a landfill are a function of the following measurable quantities:

- The rate of landfill gas (LFG) flow to the control device (flare station, power plant, or other facility that combusts collected LFG);
- The methane content of the recovered LFG; and
- The methane destruction efficiency in the control device.

Since methane is the combustion fuel for the control device and is reduced (from about 20 to 55 percent by volume of the LFG) to ppm levels as a result of combustion, the destruction efficiency will be very near 100 percent in all cases (typically about 99.9%) and destruction rates can be assumed to be 100%. Methane recovery rates are therefore considered to be equivalent to methane emissions reductions.

Standard protocols for measuring the flow rate and methane content of recovered LFG are described below. An alternative method for measuring methane combustion rates at energy recovery facilities is provided at the end of this section. Also provided is a discussion of methods for calculating methane emissions reductions at non-regulated sites.

<u>LFG Flow Rate Measurements</u>

LFG flow rates are to be measured upstream of the control device by means of an installed flow metering device. The LFG flow rate at the control device is not equivalent to the sum of LFG flows measured at individual wells (due to losses and/or air infiltration along the collection piping and the cumulative errors inherent in multiple flow rate measurements); measurement of LFG flows from individual wells is not an acceptable quantification method. The protocol for measuring LFG flow using a flow meter is described below.

Flow Meter Requirements

Instrument Description

The following description of the types of flow meters and recommended flow meter installation points has been taken from the Solid Waste Association of North America's manual of practice for landfill gas operations and maintenance.[21]

The most common types of flow meters measure flow by sensing differential pressure. Examples include the orifice plate, pitot tube, venturi tube, and the averaging pitot tube (e.g., Annubar™). These flow meters measure flow using a standard mathematical formula without the need to modify the result based on proprietary device-specific information. The Annubar™ relies on proprietary information supplied by the manufacturer, such as a correction coefficient, chart, or flow computer to determine the flow. The flow meter may be read using a pressure gauge, or it may require a differential pressure transmitter which sends a signal to the flow computer or flow readout device. Instantaneous readings are typically recorded on a chart recorder.

Other types of flow meters such as hot wire anemometers produce an electronic signal based on the cooling effect on a filament caused by the gas flow. These devices are sensitive to the LFG flow rate, the moisture content, and the gas composition, and require re-calibration to yield accurate measurements when the gas composition changes. However, they are widely used within the LFG industry and are acceptable if calibrated to site conditions.

The flow meter should be installed along the header pipe at a location that provides a straight section of pipe sufficient to establish laminar gas flow, as turbulent flow resulting from bends, obstructions, or constrictions in the pipe can cause interference with flow measurements which rely on differential pressure. The most desirable location for the flow meter is downstream of the blower and upstream of the control device because the LFG is drier and under slight pressure instead of vacuum. The flow meter may also be installed upstream of the blower and downstream of the moisture separator.

Performance Standards

The following information regarding flow meter performance must be maintained and may be required by CCX to be included in Project Reports:

- Manufacturer specifications of flow meter accuracy should be +/- 5% of reading;
- Proof of initial calibration;
- Capability to record flow every 15 minutes; and
- Means to correct for temperature and pressure.

[21] Solid Waste Association of North America, 1997. Landfill gas operation and maintenance – manual of practice.

Instrument Maintenance and Periodic Check of Flow Meter Accuracy

Installed flow meters should be inspected, cleaned, and checked for accuracy using a portable instrument such as a pitot tube to measure the flow velocities along a transverse of the header pipe. The velocity measurements are then used to calculate a flow rate, which is typically accurate to within 10 percent in larger pipes (greater than 4 inch diameter). The inspection, cleaning, and flow verification should be done at least quarterly. Alternately, annual calibration of the flow meter may be performed in lieu of the quarterly flow field check, provided that the following conditions are met:

- Calibrations are performed in accordance with manufacturer's specifications;
- Calibrations are performed by the manufacturer, or using manufacturer-approved methodologies; and
- All records of calibration reports and methodologies are documented and made available for review during the verification process.

Recordkeeping

The following records of LFG flows to the control device are to be kept in order to verify methane emissions reductions:

- Type of flow meter;
- Date and location of flow meter installation;
- Dates and results of flow meter calibration;
- Copies of charts or diskettes on which flow rates were recorded;
- Monthly tabulations of number of hours control device was shut down (no Offsets will be issued by CCX for periods during which the control device is not operated);
- Monthly tabulations of unadjusted total daily LFG flow to the control device (in actual cubic feet per day);
- Copies of field data used for flow measurement calibration;
- Monthly tabulations of daily LFG flow rate standardization calculations and results (in standard cubic feet per day);
- Information on the portable instrument and procedures used to check the installed flow meter accuracy, including field measurements and flow calculations; and
- Records of third-party verification of flow measurements and procedures.

The above-listed records need to be kept readily accessible and on-site for at least 2 years after the date that annual methane emissions reductions for the site have been recorded at the CCX and may be required by CCX to be included in Project Reports.

Methane Concentration Measurements

Measurement of the methane concentration of LFG is almost exclusively performed using an infrared gas analyzer (for example, the GEM-500 and GEM-2000 manufactured by LandTec, Inc.). Methane concentration measurements should be taken at approximately the same location as the flow meter. Measurements can be taken directly by connecting the sampling tube to a sampling port, or they can be taken from an LFG sample collected in a Tedlar bag or Summa canister or any other EPA-approved sampling method.

Instrument Requirements

Performance Standards

The following performance standards are recommended for current measurements for the calculation basis of Exchange Methane Offsets:

- Precision: Methane measurements are to be to the nearest 0.1 percent.
- Accuracy: Methane measurement accuracy decreases with increasing methane concentration but should be within +/- 10 percent of reading, as specified by the manufacturer.

Alternate instruments, including gas chromatographs or thermal conductivity detectors must meet similar standards.

Instrument Calibration Procedures

Hand-held gas analyzing instruments shall be calibrated against a gas sample with a known methane concentration prior to each day of use. A calibration gas with a methane concentration close to the concentration expected in the field (i.e., 40 to 50% methane) is optimal. Instructions in the instrument manual regarding details on the calibration procedures, including instrument adjustments and factory recommended calibration intervals shall be utilized. Records of all field and factory calibrations shall be kept at the facility.

Where permanently installed gas analyzers are in use, all calibration procedures recommended by the equipment manufacturer shall be properly adhered to. At a minimum, the analyzer shall be calibrated according to the manufacturer's recommended frequency. Records of all calibrations shall be kept at the facility.

Frequency of Recording

Although continuous monitoring of the methane concentration of recovered LFG would be optimal, it is not practical given the instruments available to the LFG industry currently. Unlike LFG flow rates, methane concentrations are not likely to vary dramatically over short time periods. The minimum frequency of measurement is at least monthly for Exchange Methane Offsets. "Grandfathered" Early Action Credits may go back to 1995 and data may not be archived for all sites. Where methane content measurement data is available, the average concentration measured for the year should be the concentration used to determine total methane destruction. Where data is not available the average landfill gas methane concentration of 45% will be used.

Recordkeeping

The following records of measured methane concentrations are to be kept in order to verify methane emissions reductions:

- Type of instrument.
- Dates and results of instrument calibration.
- Dates and results of methane measurement.
- Monthly tabulations of measured methane concentrations.
- Records of third-party verification of methane measurements and procedures.

The above-listed records need to be kept readily accessible and on-site for at least 2 years after the date that annual emissions reductions for the site have been registered with CCX and may be required by CCX to be included in Project Reports.

Calculating Total Daily, Monthly, and Annual Methane Flows

Tabulated records of total daily LFG flows (in standard cubic feet per day) need to be matched against methane concentrations measured during the corresponding time period to determine daily methane recovery rates, using equation 1:

Equation 1:

[CH_4 recovered (standard ft^3/day)] = [LFG recovered (standard ft^3/day)]x [%CH_4]

The methane value used in the calculation should be the measurement that is the closest available in time to the date of the flow measurement, and in no case be more than 4 days distant from the date of the flow measurement. Daily methane flows should be tabulated and summed on a monthly basis. Total annual methane recovery from the landfill is to be tabulated using the monthly summaries of methane recovery.

In order to estimate the amount of methane combusted in metric tons per year (Mg/yr), the annual methane recovery rate in cubic feet per year needs to be converted to weight using Equation 2:

Equation 2:

CH_4 combusted (Mg/yr) = [CH_4 recovery (ft^3/yr)] x [16.04 (molecular weight of CH_4)] x [1Mg/10^6 g]* [1mol/24.04L @ STP] x [28.32L/1cf]

Alternative Method for Calculating Methane Combustion Rates

Energy recovery facilities that use LFG as a fuel to generate electricity typically have detailed records of electrical generation rates in kilowatt-hours (kWhr) that can be used to calculate methane combustion rates. Information on the heat rate of the combustion unit in Btus per kilowatt hour (Btu/kWhr) can be used to calculate Btus of methane combusted. Typically, the high heating value of methane (1,012 Btus per cubic foot) is used to convert to a methane flow rate. The calculation can be summarized as provided in Equation 3:

Equation 3:

Methane recovery (ft^3) = [kWhr of electricity produced from the LFG fuel] x [heat rate in Btu/kWhr] / [1012 Btu/ft^3 (HHV of methane)]

To estimate annual methane combustion rates, use the amount of electricity generated over a one year period in the equation above. The heat rate used in the calculation should be from the most recent source test for the combustion device. If no source test information is available, the heat rate per the manufacturer's specifications should be used.

This alternative method for calculating methane combustion rates at energy recovery facilities is preferred over the standard method applicable to other facilities (i.e., flares) because it does not rely on monthly methane concentration measurements and is therefore more accurate.

Performance Standards

The following information regarding the measurement of methane combustion at energy recovery facilities must be maintained and may be required by CCX to be included in Project Reports:

- Type, make, and model number of combustion unit(s);

- Number of combustion units that exclusively use LFG as fuel;
- Heat rate of combustion device(s) per manufacturer's specifications;
- Copy of a summary table from the most recent source test showing the measured heat rate of combustion device(s);
- Summary tables showing kWhr of electricity produced from LFG per month over the annual period;
- Type of electrical metering device; and
- Accuracy, precision, and calibration information on the metering device per manufacturer.

PROTOCOL FOR DETERMINING ELIGIBLE METHANE EMISSIONS REDUCTIONS FROM REGULATED (NSPS) SITES

Methane emissions reductions from landfills required to collect and destroy LFG NMOC emissions due to NSPS or other regulations (including enforcement, e.g., consent order) are not eligible to earn CCX Offsets unless the emission reductions occur prior to the date that NSPS or other requirements apply.

<u>Methods for Determining Eligibility of Methane Reductions Prior to NSPS Regulation</u>

All methane recovered from a landfill prior to the date that NSPS or other regulation requires the GCCS to be operational is potentially eligible to earn CCX Offsets. Methane emissions reductions are no longer eligible starting on the date of required system start-up, except for methane recovery from new cells (see below for NSPS applicability). The NSPS-required system start-up date is 30 months after the landfill first reports that its NMOC emissions are over 50 megagrams per year. Since the NSPS rule requires regular (at least once every 5 years) reporting of current and projected NMOC emissions to the EPA, the required system start-up date is well-defined.

The protocol for establishing emissions reductions due to early system operation at NSPS sites is the same as for non-regulated sites. The same data measurement, verification, recordkeeping, and reporting procedures are to be followed, with the following additional requirements:

- Records of the system start-up date need to be kept on-site for at least 2 years after the final submittal of methane emissions reduction reports to CCX. Copies of start-up date records must be maintained and may be required by CCX to be included in Project reports**.**
- NSPS reports providing NMOC emission rate estimates, including Tier 1 and Tier 2 reports, need to be kept on site for at least 2 years after the final submittal of methane emissions reduction reports to CCX. Copies of the results of the Tier 1 and/or Tier 2 NMOC emission rate estimates and the projected date when system

start-up will be required by NSPS should be maintained and may be required by CCX to be included in Project reports. reductions to CCX.

Methods for Determining Reductions in Methane Emissions Due to Accelerated Wellfield Installation in New Refuse Cells

All methane recovered from active waste cells that have refuse in place for less than 5 years, and all methane recovered from inactive cells that have refuse in place for less than 2 years, is potentially eligible to be counted as methane emissions reductions. The protocol for determining whether the 5 or 2-year age requirement is met and for measuring methane recovery from the new cells is described below.

Protocol for Establishing Age of Refuse Cells

The following recordkeeping, reporting, and data verification procedures should be followed to establish that the 5 or 2-year age limit requirements are met:

- A plan-view site drawing showing the following items must be kept on-site for at least 2 years after the final submittal of the methane emissions reduction report to CCX may require that such documents be included in Project Reports: A delineation of the refuse cell boundaries;
  - A delineation of the refuse cell boundaries;
  - The locations of extraction wells installed in the cell;
  - The locations of collection system piping connecting the cell's extraction wells to the rest of the GCCS; and
  - The location where flow and methane measurements are taken.
- Records of showing the date that refuse was first placed in the cell must be kept on-site for at least 2 years after the final submittal of the methane emissions reduction report to the CCX and CCX may require inclusion of such records in CCX Project Reports.

Methods for Measuring Accelerated Methane Recovery from New Cells

Methods for measuring methane recovery from new refuse cells meeting the 5 and 2-year age limit include methods which rely on direct measurements alone and methods which rely on a combination of direct measurements and indirect calculations. Both approaches require that the collection system is designed to allow LFG collected from the new refuse cells to remain separate from LFG collected from other cells, at least up to the point where the LFG flows and methane content can be measured. This requirement makes necessary a separate gas conveyance line (header piping) from the new cells.

Methods relying solely on direct measurement of methane flows require the installation of a flow meter and an LFG sampling port at some point along the header pipe collecting LFG from just the new cell(s). LFG flows and methane contents are to be measured at this location using the same procedure as described previously for measurement of methane recovery from the entire landfill for eligible sites. Recordkeeping, reporting, and verification of the measured methane recovery rates and conversion of methane flows to tons of CO_2-equivalent emissions reductions are also the same as described previously.

If installation of a fixed flow meter along the header pipe collecting LFG from the new cells is not practical, periodic measurements are acceptable if the following protocol is followed:

- Establish baseline methane recovery rates from the entire (NSPS) system prior to expanding the system to collect LFG from the new cells. The baseline methane recovery rate should be in standard cubic feet per minute (scfm) and be the average value from one month of measurements taken using the measuring procedures described previously for measuring methane recovery from eligible sites. The baseline recovery rates should be representative of normal operations and not be measured when there are problems with the wellfield.
- Shortly after wells installed in the new cells are operational, conduct new measurements of average methane recovery from the entire site (in scfm), based on one month of measurements taken using the measurement procedures described previously. The difference between the new methane recovery rates and the baseline methane recovery rates equals the initial rate of incremental methane emissions reductions.
- Ongoing methane emissions reduction quantification is to be based on average methane recovery rates (in scfm) as measured along the header pipe collecting LFG exclusively from the new cells. The measurement of methane recovery from the new cells should be conducted using the following procedures:
    1. Use a portable flow measuring device such as a pitot tube that meets the standards described in a previous section, “Flow Meter Requirements.”
    2. Use an infrared gas analyzer (such as a GEM-500) or alternative instrumentation that meets the standards described in a previous section, “Methane Concentration Measurements.”
    3. Take measurements of LFG flow and methane concentrations each week, starting one week after the initial rate of methane emissions reductions is established. Adjust measured LFG flow rates to scfm.
    4. Calculate an average daily methane recovery rate from the new cells. Calculate the percentage of sitewide methane recovery derived from the new cells.

Ongoing emissions reduction quantification would be based on continuous flow monitoring (and weekly methane concentration measurements) for the entire system and weekly LFG flow and methane concentration measurements from the expansion system only. If fluctuations in total site methane recovery are indicated, compare the most recent measured methane recovery rate from the new cells with an estimated methane recovery rate from the new cells calculated from the total site methane recovery rate and the most recently measured percentage of methane recovery from the new cells. Use the lower of the two methane recovery values.

Recordkeeping, Reporting, and Verification Requirements

Recordkeeping, reporting, and data verification requirements described above for measuring methane recovery from eligible sites and for confirming that the 5 and 2-year refuse age requirements are met are applicable to NSPS or similarly affected landfills that recover additional methane as a result of accelerated installation of wells in new cells

As indicated above, additional calculation steps will be required to calculate daily methane recovery from average methane recovery rates (in scfm) at landfills that use indirect methods to calculate methane recovery from accelerated installation of wells in new cells.

Appendix 9.1B Protocol For Quantifying Greenhouse Gas Reductions From Agricultural Methane Capture (2007)

Eligibility

Projects eligible for anaerobic digester offsets must have prior (baseline) manure management practices[22,23] where manure is handled as a liquid and with significant methane emitting potential, including:

1. Liquid/slurry storage
2. Pit storage below animal confinements (for periods exceeding one month)
3. Uncovered anaerobic lagoons

Eligible projects with additional baseline manure management systems other than those listed above may include only that portion of the manure handled by eligible systems in any baseline emission and offset credit calculations.

Although the use of non-manure feedstocks may result in additional emission reductions, such use should be treated as a separate project activity and is not included in the specific calculation of agricultural methane offsets for anaerobic manure digester projects.

Baseline calculation

The emissions baseline is the amount of methane that would be emitted to the atmosphere during the crediting period in the absence of the anaerobic digester project. For each year during the crediting period, baseline emissions for all anaerobic digesters are calculated as specified in paragraph (a) and paragraph (b) below, and the lower of the two values will be used:

(c) Actual monitored amount of methane captured and destroyed by the project activity using existing CCX monitoring protocols and a GWP for methane of 21). The default methane combustion efficiency for flared biogas from anaerobic digesters is 90%. Higher efficiencies may be used if supported by manufacturer's specifications or other acceptable data. The default methane combustion efficiency for biogas utilized by electricity gensets is 100%.

(d) The methane emission calculated ex ante based on the amount of the animal manure that would decay anaerobically in the absence of the project activity, using the most

[22] IPCC 2000, Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (May 2000)
[23] Table 10.18. Definitions of Manure Management Systems. 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

recent country-specific IPCC tier 2 approach (for a description of the proposed calculation methods for projects in the U.S., see Appendix B).

Exclusion of nitrous oxide emissions from baseline calculations

Eligible projects, as defined above, utilize liquid manure management systems for baseline determination. Direct nitrous oxide emissions for these liquid manure management systems is expected to be relatively small based on IPCC and US National Inventory accounting methods and default emission factors; in most cases contributing significantly less than 5% of the total baseline GHG emissions. Therefore potential nitrous oxide emissions are excluded from baseline calculations. Projects that may reduce direct or indirect nitrous oxide emissions resulting in additional emission reductions would need to account for such reductions as a separate project activity.

Agriculture Methane Emission Destruction

This protocol provides the methods to be employed in quantifying methane combustion by agricultural methane Projects. The Project Verifier must document (among other items):

(4) the Project Owner's clear ownership rights to Greenhouse Gas emission reductions associated with sites included in the Project;
(5) eligibility of the site to earn CCX XMOs; and,
(6) records of methane content and total gas flows or total electricity generation and engine manufacturer's efficiency rating (if applicable).

XMO Project Registration, Verification and Project Reports

Registration of each CCX XMO Project must be accompanied by a Project eligibility statement prepared by a CCX-approved Verifier. The Project Registration Filing must include a signed attestation that the entity registering as the CCX Project Owner holds full legal title to the Greenhouse Gas mitigation rights registered as CCX Exchange Offsets that are associated with the facilities included in the registered Project. The filings must contain an attestation by a CCX-approved Verifier as to the quantity of mitigation achieved and Exchange Offset issuance that is prepared in conformance with the rules provided herein, and with the verification protocols prescribed by the Exchange.

Protocol for Quantifying Greenhouse Gas Reductions from Anaerobic Manure Digesters

Introduction

The purpose of this protocol is to address the measurement and verification of methane emissions reductions from the combustion of biogas for the Chicago Climate Exchange (CCX).

Topics covered in this document:

- Overall approach for crediting methane reductions from anaerobic digestion of animal manure as emission offsets;
- Protocol for measuring, recording, and verifying anaerobic digester methane recovery rates based on biogas flow and methane measurements; and,
- Protocol for verifying ex ante calculation of methane generation.

Topics not included:

- Accounting for (carbon dioxide) emissions reductions that may result from displacement of other fuels used in power production; and

Requirements and Overall Approach for Crediting Methane Reductions

For CCX purposes, anaerobic digesters are treated as providers of Exchange Methane Offsets. CCX eligibility requirements for methane reductions from anaerobic digesters include the following:

- A company must demonstrate clear ownership rights of the emission reductions from the destruction of methane in order to register the offsets with CCX.
- Projects eligible to earn offsets during the years 2003 through 2006 are those placed into service on or after January 1, 1999.
- Except as may be provided by CCX, procedures outlined in this protocol must be followed to quantify methane emission reductions.
- Eligible animal manure biogas methane collection and combustion systems will be issued Offsets for methane collected and destroyed in accordance with this protocol. Such issuance shall occur at a rate of 21 metric tons CO_2 per metric ton of methane.

The overall approach to quantifying methane emissions reductions described in this report is to rely on the lesser of measured or calculated quantities of methane collected through the operation of an anaerobic digester and destroyed by combustion in a flare or energy recovery facility. Details on acceptable methods for recording rates of methane emissions reduction from combustion of biogas produced from anaerobic digestion of animal manures are provided.

Although there are no regulations currently requiring the control of biogas emissions from the treatment of animal manures using anaerobic digestion or other methods, the USEPA's National Resource Conservation Service has published a guidance document for the operation of three categories of anaerobic digesters, including: (1) covered anaerobic lagoons; (2) complete mix digesters; and (3) plug flow digesters. The guidance document contains practice standards that should be followed at anaerobic digester facilities seeking to earn offsets through methane emissions reductions. The standards are included as Appendix F of a handbook on the use of biogas technologies for managing livestock manure, which is available on the web at http://www.epa.gov/outreach/agstar/library/handbook/appendixf.pdf.

Protocol for Quantifying Methane Emissions Reductions

Rates of methane capture and destruction at a biogas facility are a function of the following measurable quantities:

- The rate of biogas flow to the control device (flare station, power plant, or other facility that combusts collected biogas);
- The methane content of the recovered biogas; and
- The methane destruction efficiency in the control device.

Standard protocols for measuring the flow rate and methane content of recovered biogas are described below. An alternative method for measuring methane combustion rates at energy recovery facilities also is provided.

Biogas Flow Rate Measurements

Biogas flow rates are to be measured upstream of the control device by means of an installed flow meter device. The protocol for measuring biogas flow using a flow meter is described below.

Flow Meter Requirements

The following description of the types of flow meters and recommended flow meter installation points has been taken from the Solid Waste Association of North America's manual of practice for landfill gas operations and maintenance.[24]

The most common types of flow meters measure flow by sensing differential pressure. Examples include the orifice plate, pitot tube, venturi tube, and the averaging pitot tube (e.g., Annubar™). These flow meters measure flow using a standard mathematical formula without the need to modify the result based on proprietary device-specific information. The Annubar™ relies on proprietary information supplied by the manufacturer, such as a correction coefficient, chart, or flow computer to determine the flow. The flow meter may be read using a pressure gauge, or it may require a differential pressure transmitter which sends a signal to the flow computer or flow readout device. Instantaneous readings are typically recorded on a chart recorder.

Other types of flow meters such as hot wire anemometers produce an electronic signal based on the cooling effect on a filament caused by the gas flow. These devices are sensitive to the biogas flow rate, the moisture content, and the gas composition, and require re-calibration to yield accurate measurements when the gas composition changes. However, they are widely used within the biogas industry and are acceptable if calibrated to site conditions.

The flow meter should be installed along the header pipe at a location that provides a straight section of pipe sufficient to establish laminar gas flow, as turbulent flow resulting from bends, obstructions, or constrictions in the pipe can cause interference with flow measurements which rely on differential pressure. The most desirable location for the flow meter is downstream of the blower and upstream of the control device because the biogas is drier and under slight pressure instead of vacuum.

The following information regarding flow meter performance must be maintained and may be required by CCX to be included in Project Reports:

- Accuracy, precision per manufacturer;
- Proof of initial calibration;
- Means to correct for temperature and pressure.

Installed flow meters should be inspected, cleaned, and checked for accuracy using a portable instrument such as a pitot tube to measure the flow velocities along a transverse of the header pipe. The velocity measurements are then used to calculate a flow rate, which is typically accurate to within 2 percent in larger pipes (greater than 4 inch diameter). The inspection, cleaning, and flow verification should be done at least quarterly.

[24] Solid Waste Association of North America, 1997. Landfill gas operation and maintenance – manual of practice.

Recordkeeping

The following records of biogas flows to the control device are to be kept in order to verify methane emissions reductions:

- Type of flow meter;
- Date and location of flow meter installation;
- Dates and results of flow meter calibration;
- Copies of charts or diskettes on which flow rates were recorded;
- Monthly tabulations of number of hours control device was shut down (no offsets will be issued by CCX for periods during which the control device is not operated);
- Copies of field data used for flow measurement standardization, including barometric pressure, biogas temperature and pressure measurements, and biogas characteristics (percent methane, oxygen, water);
- Monthly tabulations of hourly biogas flow rate standardization calculations and results (in standard cubic feet per hour);
- Information on the portable instrument and procedures used to check the installed flow meter accuracy, including field measurements and flow calculations; and
- Records of third-party verification of flow measurements and procedures.

The above-listed records need to be kept readily accessible and on-site for at least 2 years after the date that annual methane emissions reductions for the site have been recorded at the CCX and may be required by CCX to be included in Project Reports.

Third-Party Verification of Gas Flow Measurements and Procedures

At least once per year, biogas flow measurements, records, and procedures should be verified as acceptable per the CCX protocol by a CCX-approved Verifier.

Methane Concentration Measurements

Offset providers who wish to use default factors (provided below) for methane concentration are required to provide laboratory analysis of methane concentration at least once per year. Offset providers who wish to receive credit for values in excess of the established default values must provide hourly averaged methane concentration data using the protocols described below.

Default values for methane concentration:

- Entities able to provide laboratory analysis of methane concentration between 70.0% and 74.9% for biogas digesters will be assigned a default value of 70%.
- Entities able to provide laboratory analysis of methane concentration between 65.0% and 69.9% for biogas digesters will be assigned a default value of 65%.
- Entities able to provide laboratory analysis of methane concentration between 60.0% and 64.9% for biogas digesters will be assigned a default value of 60%.

Default values will be reevaluated on a yearly basis and will be adjusted according to the most current laboratory analysis.

The methane concentration of biogas is typically measured using instrumentation located inside the digester, as methane concentrations are an important parameter to be monitored during digester operations. Instruments collect samples from gases that accumulate near the roof of the digester and provide periodic or continuous biogas methane concentrations.

The following information regarding methane concentration measurement instrumentation must be submitted:

- Accuracy, precision per manufacturer;
- Proof of initial calibration;
- Records of periodic instrument calibration (according to the manufacturers instructions for calibration);
- Capability to record methane concentrations at least every 15 minutes for entities not using default values for methane content.

The gas analyzer instrument needs to be calibrated against a gas sample with a known methane concentration at least once per year. See instructions in the instrument manual for details on the calibration procedures, including instrument adjustments. A calibration gas with a methane concentration close to the concentration expected in the field (i.e., 60-70% methane) is optimal.

Recordkeeping

The following records of measured methane concentrations are to be kept in order to verify methane emissions reductions:

- Type of instrument.
- Dates and results of instrument calibration.
- Dates, times, and results of methane measurement.
- Records of laboratory analysis of methane concentration- at least once per year.

- For entities not using default methane concentration factors- monthly tabulations of unadjusted average methane concentration of recovered biogas during each hour of digester operation, based on the average methane concentration measured during four 15-minute periods.
- Records of third-party verification of methane measurements and procedures.

The above-listed records need to be kept readily accessible and on-site for at least 2 years after the date that annual emissions reductions offsets for the site have been recorded at the CCX.

Third-Party Verification of Methane Measurements and Procedures

At least once per year, methane concentration measurements, records, and procedures should be verified as acceptable per the CCX protocol by a CCX-approved Verifier.

Use of Measured Data to Calculate Methane Emissions Reductions from Anaerobic Digesters

Methods for calculating the amount of methane recovered from anaerobic digesters and combusted are described below.

Methane concentrations should be measured at a minimum of once per year. Default factors will be applied to all offset providers who do not provide methane concentrations on an hourly basis as described below. Tabulated records of average hourly biogas flows (in standard cubic feet per hour) need to be matched against methane concentrations measured during the corresponding time period to determine hourly methane recovery rates, using the following equation:

[CH_4 recovered (standard ft^3/hour)] = [average biogas recovery rate (standard ft^3/hour)]x [average hourly %CH_4].

Calculated hourly methane flows should be tabulated and summed on a daily and monthly basis. Total annual methane recovery from the digester is to be tabulated using the monthly summaries of methane recovery.

In order to estimate the amount of methane combusted in metric tons per year (Mg/yr), the annual methane recovery rate in cubic feet per year needs to be converted to weight using the following formula:

CH_4 combusted (Mg/yr) = [CH_4 recovery (ft^3/yr)] x [16 (molecular weight of CH_4)] x [1Mg/10^6 g]* [1mol/24.04L @ STP] x [28.32L/1cf]

Third-Party Verification of Methane Combustion Rate Calculations

For offset providers who desire to use actual hourly methane concentrations all calculations of hourly, daily, monthly, and annual methane recovery rates, and metric tons of methane combusted, need to be verified as acceptable per the CCX protocol by a CCX-approved Verifier prior to submitting records of annual amounts of methane combusted.

Alternative Method for Calculating Methane Combustion Rates

Energy recovery facilities that use biogas as a fuel to generate electricity typically have detailed records of electrical generation rates in kilowatt-hours (kWhr) that can be used to calculate methane combustion rates. Information on the heat rate of the combustion unit in Btus per kilowatt hour (Btu/kWhr) can be used to calculate Btus of methane combusted. Typically, the high heating value of methane (1,012 Btus per cubic foot) is used to convert to a methane flow rate. The calculation can be summarized as follows:

Methane recovery (ft^3) = [kWhr of electricity produced from the biogas fuel] x [heat rate in Btu/kWhr] / [1012 Btu/ft^3 (HHV of methane)]

For estimating annual methane combustion rates, use the amount of electricity generated over a one-year period in the equation above. The heat rate used in the calculation should be from the most recent source test for the combustion device. If no source test information is available, the heat rate per the manufacturer's specifications should be used.

The following information regarding the measurement of methane combustion at energy recovery facilities must be submitted:

- Type, make, and model number of combustion unit(s);
- Number of combustion units that exclusively use biogas as fuel;
- Heat rate of combustion device(s) per manufacturer's specifications;
- Copy of a summary table from the most recent source test showing the measured heat rate of combustion device(s);
- Summary tables showing kWhr of electricity produced from biogas per month over the annual period;
- Type of electrical metering device; and

- Accuracy, precision, and calibration information on the metering device per manufacturer.

Prior to submitting methane recovery rates to be recorded as metric tons of methane combusted, all calculations of annual methane recovery rates need to be verified as acceptable per the CCX protocol by a CCX-approved Verifier.

Ex Ante Calculations of Baseline Methane Emissions for U.S. Manure Digester Projects

The following procedure for ex ante calculation of baseline methane emissions from manure digester projects in the U.S. follows the IPCC Tier 2 approach and emission factors used in the most recent U.S. Greenhouse Gas Inventory Report[27]

The procedure includes the following general steps for each reporting period (annual reporting is recommended to account for seasonal variability in animal populations and baseline emissions):

1. Characterize the average livestock populations included in the anaerobic digester project for the reporting period;
2. Characterize the baseline manure management system(s) for the project;
3. For each livestock population category and baseline manure management system, multiply the number of animals by the appropriate emission factor for that state (from Tables B.2 and B.3), by the appropriate solids separation correction factor, by the proportion of manure from those animals used in the digester, by the number of days in the period (Equation 1);
4. Sum the estimates for all population categories and baseline manure management systems (Equation 1);
5. Multiply the total estimate of methane emission by the appropriate methane GWP for the reporting period (Equation 2).

(Equation 1)
$$CH_{4Manure} = \sum_{T,S} N_{(T)} \bullet EF_{(T,S,St)} \bullet SSCF_{(S)} \bullet MS_{(T,S)} \bullet P_{days}$$

(Equation 2)
$$CO_2e_{Baseline} = \frac{CH_{4Manure} \bullet GWP_{Methane}}{1{,}000};$$

Where:

$CH_4Manure$ = CH_4 emissions from manure management (kg $CH_4 \cdot period^{-1}$)

N(T)	=	Number of animals in livestock species/category T included in the project (head)
EF(T,S,St)	=	Methane emission factor for livestock category T, manure management system S, and state St (kg $CH_4 \cdot head^{-1} \cdot day^{-1}$); from Tables B.2 and B.3.
SSCF(S)	=	Solids separation correction factor for manure management system S (unitless fraction)
MS(T,S)	=	Fraction of livestock category T's manure handled using manure management system S (unitless fraction)
Pdays	=	number of days in the reporting period (days)
$CO_{2eBaseline}$	=	Baseline emissions (Mg CO_2 equivalents $\cdot$ period^{-1})
$GWP_{Methane}$	=	Global warming potential of methane (kg $CO_{2e} \cdot kg^{-1}$ CH_4)
1,000	=	Mass conversion factor (kg $CO_{2e} \cdot Mg^{-1}$ CO_{2e})

Livestock Categories

Livestock categories (T) included in this method are listed in Table B.1. For market swine (finishing operations), the use of a population-wide average animal weight is an acceptable conservative alternative.

Table B.1 – Livestock categories and waste characteristics included in baseline methane emission calculations and emission factor derivation1

Livestock Category, T	***Average TAM[2]***	***Total Kjeldhal N Excretion Rates, N_{ex}***	***Maximum Methane Generation Potential, B_o***	***Volatile Solids, VS***
Units	*(kg)*	*(kg/day per 1,000 kg mass)*	*(m3 CH4/kg VS)*	*(kg/day per 1,000 kg mass)*
Dairy Cattle				
Dairy Cows	604	0.44	0.24	(from Table B.4)
Dairy Heifer	476	0.31	0.17	(from Table B.4)
Beef Cattle				
Feedlot Steers	420	0.30	0.33	(from Table B.4)
Feedlot Heifers	420	0.30	0.33	(from Table B.4)
Swine				
Market < 60 lbs	16	0.60	0.48	8.8
Market 60-119 lbs	41	0.42	0.48	5.4
Market 120-179 lbs	68	0.42	0.48	5.4
Market >180 lbs	91	0.42	0.48	5.4
Breeding	198	0.24	0.48	2.6

[1]Data From Table A-157, Appendix 3.9, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004
[2]Typical Animal Mass

Emission Factors

State-specific methane emission factors (EF(T,S,St)) for each livestock category (T) and baseline manure management system (S) included in this method are listed in Tables B.2 and B.3. Emission factors were derived as in Equation 3 using typical animal mass (TAM) and maximum methane generation potential (Bo) data from Table A.1, and using state-specific data for volatile solids production rates (VS) and methane conversion factors (MCF) for the different baseline manure management systems from Tables B.4 and B.5.

(Equation 3)

$$EF_{(T,S,St)} = TAM_{(T)} \bullet \frac{VS_{(T,St)}}{1{,}000} \bullet B_{o(T)} \bullet 0.67 \bullet \frac{MCF_{(S,St)}}{100}$$

Where:

EF(T,S,St) = CH_4 emission factor for livestock category T, manure management system S and state St (kg $CH_4 \cdot head^{-1} \cdot day^{-1}$); from Tables B.2 and B.3.

TAM(T) = Typical animal mass for livestock species/category T (kg $\cdot$ $head^{-1}$)

VS(T,St) = Volatile solids production rate for each livestock category and state (kg VS $\cdot$ $day^{-1} \cdot 1{,}000\ kg^{-1}$ animal mass)

Bo(T) = Maximum CH_4 generation potential for livestock category T ($m^3\ CH_4 \cdot kg^{-1}$ VS)

MCF(S,St) = Methane conversion factor for baseline manure management system S, and state St (%)

0.67 = CH_4 volume to mass conversion factor (kg $CH_4 \cdot m^{-3}\ CH_4$)

1,000 = VS conversion factor (kg animal mass $\cdot$ 1000 kg^{-1} animal mass)

100 = MCF percentage conversion factor

Solids Separation Correction Factor

For baseline liquid slurry storage or anaerobic lagoon manure management systems that separate manure solids prior to the input of liquid manure, a default solids separation correction factor (SSCF) of 0.8 must be used to calculate baseline emissions. Project specific correction factors may be used if supported by manufacturer's specifications or other acceptable data. For those systems that do not separate solids, or that utilize simple gravity separation of sand and other non-manure solids, the SSCF is equal to 1.

For projects which did not use solids separation in the baseline case, but subsequently utilize solids separation prior to the input of liquid manure to the digester, the separated solids must be handled in a manner that ensures negligible production of methane (e.g., aerobic composting, use as animal bedding, or daily spread), otherwise, the appropriate solids separation correction factor must be used to calculate baseline emissions.

Sample Baseline Emission Values

Tables B.6 and B.7 give annual baseline GHG emissions, as metric tons of CO_{2e} per head, for liquid slurry/pit storage and anaerobic lagoon manure management systems by livestock category (T) and state, assuming no solids separation and a global warming potential for methane of 21.

Clarification of definitions for baseline manure management systems

The CCX baseline calculation requires that a project baseline manure management practice be defined as "Liquid/Slurry", "Deep Pit", or "Anaerobic Lagoon." Higher methane conversion factors (MCF's) (Table B.5) result if a project is eligible to claim Anaerobic Lagoon status.

CCX has selected the following three most appropriate definitions and reference sources for the eligible practices that define the controlling factors as to which eligibility category may be used for baseline calculation purposes. These references include the IPCC 2000 good practice guidance document[25], the IPCC 2006 guidelines[26], and, for US projects, the US National GHG Inventory[27]. Simplified definitions are as follows:

1. Liquid/Slurry:
   Manure is stored as excreted or with some minimal addition of water to facilitate handling and is stored in either tanks or earthen ponds, usually for periods less than one year.

[25] IPCC 2000, Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (May 2000).
[26] IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Chp. 10: Livestock Emissions).
[27] US EPA (2007) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005.

2. Pit Storage Below Animal Confinement:
   Collection and storage of manure usually with little or no added water typically below a slatted floor in an enclosed animal confinement facility. Typical storage periods range from 5 to 12 months, but must exceed one month.

3. Anaerobic Lagoons:
   Uncovered anaerobic lagoons are designed and operated to combine waste stabilization and storage. Lagoon supernatant is usually used to remove manure from the associated confinement facilities to the lagoon. Anaerobic lagoons are designed with varying lengths of storage (up to a year or greater), depending on the climate region, the volatile solids loading rate, and other operational factors.

   Manure management systems that utilize flush technologies to handle manure, or that combine scraped (or vacuumed) manure with more than minimal quantities of water in storage (for example, by mixing dairy parlor waste water with manure for handling or storage), and that have liquid manure storage systems with hydraulic retention times of greater than 90 days, may, for the purposes of the offset protocol, be categorized as "anaerobic lagoon" systems for baseline determination.

Table B.2 – Methane emission factors (EF(T,S,St)) for liquid slurry/pit storage baseline manure management systems (S) by livestock category (T) and State (St); (kg $CH_4 \cdot head^{-1} \cdot day^{-1}$).

State	Dairy Cow	Dairy Heifer	Feedlot Steers	Feedlot Heifers	Market Swine <60 lbs.	Market Swine 60-119 lbs.	Market Swine 120-179 lbs.	Market Swine >180 lbs.	Breeding Swine
Alabama	0.317	0.142	0.143	0.138	0.017	0.027	0.045	0.061	0.064
Alaska	0.146	0.051	0.051	0.049	0.006	0.010	0.016	0.022	0.023
Arizona	0.562	0.196	0.195	0.189	0.024	0.038	0.063	0.084	0.088
Arkansas	0.300	0.148	0.132	0.128	0.016	0.026	0.043	0.057	0.060
California	0.342	0.139	0.139	0.134	0.017	0.027	0.045	0.060	0.062
Colorado	0.186	0.082	0.081	0.079	0.010	0.016	0.026	0.035	0.037
Connecticut	0.195	0.079	0.089	0.086	0.011	0.017	0.028	0.038	0.040
Delaware	0.243	0.099	0.110	0.107	0.013	0.021	0.035	0.047	0.049
Florida	0.429	0.193	0.193	0.188	0.024	0.037	0.062	0.082	0.086
Georgia	0.315	0.141	0.142	0.138	0.017	0.027	0.045	0.061	0.063
Hawaii	0.630	0.220	0.219	0.212	0.027	0.043	0.071	0.094	0.099
Idaho	0.245	0.086	0.085	0.082	0.011	0.017	0.027	0.037	0.038
Illinois	0.222	0.099	0.100	0.097	0.012	0.019	0.032	0.043	0.045
Indiana	0.215	0.096	0.097	0.094	0.012	0.019	0.031	0.041	0.043
Iowa	0.204	0.091	0.092	0.089	0.011	0.018	0.029	0.039	0.041
Kansas	0.268	0.118	0.117	0.113	0.014	0.023	0.038	0.050	0.053
Kentucky	0.250	0.112	0.113	0.109	0.014	0.022	0.036	0.048	0.050
Louisiana	0.383	0.189	0.168	0.163	0.021	0.033	0.054	0.073	0.076
Maine	0.159	0.065	0.072	0.070	0.009	0.014	0.023	0.031	0.032
Maryland	0.225	0.092	0.103	0.099	0.012	0.020	0.033	0.044	0.046
Massachusetts	0.189	0.077	0.086	0.083	0.011	0.017	0.027	0.037	0.038
Michigan	0.182	0.081	0.082	0.079	0.010	0.016	0.026	0.035	0.036
Minnesota	0.188	0.084	0.085	0.082	0.010	0.016	0.027	0.036	0.038
Mississippi	0.330	0.148	0.149	0.144	0.018	0.029	0.047	0.063	0.066
Missouri	0.251	0.112	0.113	0.110	0.014	0.022	0.036	0.048	0.050
Montana	0.177	0.078	0.077	0.075	0.010	0.015	0.025	0.033	0.035
Nebraska	0.224	0.099	0.098	0.094	0.012	0.019	0.032	0.042	0.044
Nevada	0.271	0.095	0.094	0.091	0.012	0.018	0.030	0.041	0.043
New Hampshire	0.172	0.070	0.078	0.075	0.010	0.015	0.025	0.033	0.035
New Jersey	0.216	0.088	0.098	0.095	0.012	0.019	0.031	0.042	0.044
New Mexico	0.344	0.120	0.120	0.116	0.015	0.023	0.038	0.052	0.054
New York	0.177	0.072	0.081	0.078	0.010	0.015	0.026	0.034	0.036
North Carolina	0.277	0.124	0.125	0.121	0.015	0.024	0.040	0.053	0.056
North Dakota	0.182	0.080	0.079	0.077	0.010	0.015	0.026	0.034	0.036
Ohio	0.205	0.092	0.092	0.089	0.011	0.018	0.029	0.039	0.041
Oklahoma	0.303	0.150	0.133	0.129	0.017	0.026	0.043	0.058	0.060
Oregon	0.241	0.084	0.084	0.081	0.010	0.016	0.027	0.036	0.038
Pennsylvania	0.206	0.084	0.094	0.091	0.011	0.018	0.030	0.040	0.042
Rhode Island	0.201	0.082	0.091	0.088	0.011	0.018	0.029	0.039	0.041
South Carolina	0.311	0.140	0.140	0.136	0.017	0.027	0.045	0.060	0.063
South Dakota	0.203	0.089	0.089	0.086	0.011	0.017	0.029	0.038	0.040
Tennessee	0.268	0.120	0.121	0.117	0.015	0.023	0.038	0.052	0.054
Texas	0.345	0.171	0.152	0.147	0.019	0.030	0.049	0.066	0.069
Utah	0.277	0.097	0.096	0.093	0.012	0.019	0.031	0.041	0.043
Vermont	0.165	0.067	0.075	0.073	0.009	0.014	0.024	0.032	0.033
Virginia	0.230	0.103	0.103	0.100	0.013	0.020	0.033	0.044	0.046
Washington	0.247	0.086	0.086	0.083	0.011	0.017	0.028	0.037	0.039
West Virginia	0.207	0.084	0.094	0.091	0.011	0.018	0.030	0.040	0.042
Wisconsin	0.185	0.083	0.083	0.081	0.010	0.016	0.026	0.035	0.037
Wyoming	0.179	0.079	0.078	0.075	0.010	0.015	0.025	0.034	0.035

Table B.3 – Methane emission factors (EF(T,S,St)) for anaerobic lagoon baseline manure management systems (S) by livestock category (T) and State (St); (kg $CH_4 \cdot head^{-1} \cdot day^{-1}$).

State	Dairy Cow	Dairy Heifer	Feedlot Steers	Feedlot Heifers	Market Swine <60 lbs.	Market Swine 60-119 lbs.	Market Swine 120-179 lbs.	Market Swine >180 lbs.	Breeding Swine
Alabama	0.624	0.280	0.281	0.272	0.034	0.054	0.090	0.120	0.125
Alaska	0.510	0.178	0.177	0.171	0.022	0.034	0.057	0.076	0.080
Arizona	0.837	0.293	0.291	0.281	0.036	0.056	0.094	0.125	0.131
Arkansas	0.630	0.311	0.277	0.269	0.034	0.054	0.090	0.120	0.126
California	0.692	0.281	0.280	0.271	0.035	0.054	0.090	0.120	0.126
Colorado	0.560	0.246	0.244	0.236	0.030	0.047	0.079	0.105	0.110
Connecticut	0.567	0.231	0.258	0.249	0.031	0.049	0.082	0.110	0.115
Delaware	0.604	0.246	0.275	0.266	0.033	0.053	0.087	0.117	0.122
Florida	0.640	0.287	0.288	0.280	0.035	0.055	0.092	0.123	0.129
Georgia	0.622	0.279	0.280	0.272	0.034	0.054	0.089	0.119	0.125
Hawaii	0.814	0.285	0.283	0.273	0.035	0.055	0.091	0.122	0.128
Idaho	0.721	0.252	0.251	0.242	0.031	0.049	0.081	0.108	0.113
Illinois	0.591	0.264	0.266	0.258	0.032	0.051	0.084	0.113	0.118
Indiana	0.584	0.261	0.262	0.254	0.032	0.050	0.083	0.112	0.117
Iowa	0.576	0.257	0.259	0.251	0.032	0.050	0.082	0.110	0.115
Kansas	0.625	0.275	0.273	0.264	0.034	0.053	0.088	0.118	0.123
Kentucky	0.602	0.270	0.271	0.263	0.033	0.052	0.086	0.116	0.121
Louisiana	0.641	0.316	0.282	0.273	0.035	0.055	0.091	0.122	0.128
Maine	0.517	0.210	0.235	0.227	0.029	0.045	0.075	0.100	0.105
Maryland	0.589	0.240	0.268	0.259	0.033	0.051	0.085	0.114	0.119
Massachusetts	0.561	0.228	0.255	0.247	0.031	0.049	0.081	0.109	0.114
Michigan	0.551	0.246	0.248	0.240	0.030	0.047	0.079	0.105	0.110
Minnesota	0.561	0.251	0.252	0.245	0.031	0.048	0.080	0.107	0.112
Mississippi	0.626	0.281	0.282	0.273	0.034	0.054	0.090	0.120	0.126
Missouri	0.610	0.272	0.274	0.266	0.033	0.053	0.087	0.117	0.122
Montana	0.553	0.243	0.241	0.233	0.030	0.047	0.078	0.104	0.109
Nebraska	0.600	0.264	0.262	0.253	0.032	0.051	0.084	0.113	0.118
Nevada	0.744	0.260	0.259	0.250	0.032	0.050	0.083	0.111	0.117
New Hampshire	0.535	0.218	0.243	0.235	0.030	0.047	0.077	0.104	0.108
New Jersey	0.587	0.239	0.267	0.258	0.033	0.051	0.085	0.114	0.119
New Mexico	0.785	0.275	0.273	0.264	0.034	0.053	0.088	0.118	0.123
New York	0.544	0.221	0.247	0.239	0.030	0.047	0.079	0.105	0.110
North Carolina	0.614	0.275	0.276	0.268	0.034	0.053	0.088	0.118	0.124
North Dakota	0.561	0.247	0.245	0.237	0.030	0.048	0.079	0.106	0.111
Ohio	0.574	0.257	0.258	0.250	0.031	0.049	0.082	0.110	0.115
Oklahoma	0.632	0.312	0.278	0.269	0.034	0.054	0.090	0.120	0.126
Oregon	0.707	0.247	0.246	0.238	0.030	0.048	0.079	0.106	0.111
Pennsylvania	0.575	0.234	0.261	0.253	0.032	0.050	0.083	0.111	0.117
Rhode Island	0.575	0.234	0.261	0.253	0.032	0.050	0.083	0.111	0.117
South Carolina	0.624	0.280	0.281	0.272	0.034	0.054	0.090	0.120	0.125
South Dakota	0.584	0.257	0.255	0.246	0.032	0.050	0.082	0.110	0.115
Tennessee	0.610	0.274	0.275	0.267	0.034	0.053	0.088	0.117	0.123
Texas	0.639	0.316	0.281	0.272	0.035	0.055	0.091	0.122	0.127
Utah	0.751	0.263	0.261	0.252	0.032	0.051	0.084	0.112	0.118
Vermont	0.527	0.214	0.240	0.232	0.029	0.046	0.076	0.102	0.107
Virginia	0.592	0.266	0.267	0.259	0.033	0.051	0.085	0.114	0.119
Washington	0.717	0.251	0.249	0.241	0.031	0.048	0.080	0.107	0.112
West Virginia	0.570	0.232	0.259	0.251	0.032	0.050	0.082	0.110	0.116
Wisconsin	0.560	0.250	0.251	0.244	0.031	0.048	0.080	0.107	0.112
Wyoming	0.554	0.244	0.241	0.234	0.030	0.047	0.078	0.104	0.109

Table B.4 – Volatile solids production rates (VS(T,St)) by livestock category (T) and State (St)1 used for derivation of methane emission factors (EF(T,S,St)); (kg VS · day^{-1} · 1,000 kg^{-1} animal mass).

State	Dairy Cow	Dairy Heifer	Feedlot Steers	Feedlot Heifers
Alabama	8.47	6.81	3.87	3.99
Alaska	10.87	6.81	3.82	3.95
Arizona	10.87	6.81	3.82	3.95
Arkansas	8.55	7.56	3.81	3.93
California	9.35	6.81	3.83	3.96
Colorado	8.64	6.81	3.81	3.94
Connecticut	8.41	6.13	3.87	4.00
Delaware	8.41	6.13	3.87	4.00
Florida	8.47	6.81	3.87	3.99
Georgia	8.47	6.81	3.87	3.99
Hawaii	10.87	6.81	3.82	3.95
Idaho	10.87	6.81	3.82	3.95
Illinois	8.51	6.81	3.88	4.00
Indiana	8.51	6.81	3.88	4.00
Iowa	8.51	6.81	3.88	4.00
Kansas	8.64	6.81	3.81	3.94
Kentucky	8.47	6.81	3.87	3.99
Louisiana	8.55	7.56	3.81	3.93
Maine	8.41	6.13	3.87	4.00
Maryland	8.41	6.13	3.87	4.00
Massachusetts	8.41	6.13	3.87	4.00
Michigan	8.51	6.81	3.88	4.00
Minnesota	8.51	6.81	3.88	4.00
Mississippi	8.47	6.81	3.87	3.99
Missouri	8.51	6.81	3.88	4.00
Montana	8.64	6.81	3.81	3.94
Nebraska	8.64	6.81	3.81	3.94
Nevada	10.87	6.81	3.82	3.95
New Hampshire	8.41	6.13	3.87	4.00
New Jersey	8.41	6.13	3.87	4.00
New Mexico	10.87	6.81	3.82	3.95
New York	8.41	6.13	3.87	4.00
North Carolina	8.47	6.81	3.87	3.99
North Dakota	8.64	6.81	3.81	3.94
Ohio	8.51	6.81	3.88	4.00
Oklahoma	8.55	7.56	3.81	3.93
Oregon	10.87	6.81	3.82	3.95
Pennsylvania	8.41	6.13	3.87	4.00
Rhode Island	8.41	6.13	3.87	4.00
South Carolina	8.47	6.81	3.87	3.99
South Dakota	8.64	6.81	3.81	3.94
Tennessee	8.47	6.81	3.87	3.99
Texas	8.55	7.56	3.81	3.93
Utah	10.87	6.81	3.82	3.95
Vermont	8.41	6.13	3.87	4.00
Virginia	8.47	6.81	3.87	3.99
Washington	10.87	6.81	3.82	3.95
West Virginia	8.41	6.13	3.87	4.00
Wisconsin	8.51	6.81	3.88	4.00
Wyoming	8.64	6.81	3.81	3.94

[1]Data from Table A-158, Appendix 3.10, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004

Table B.5 – Methane conversion factors ($MCF_{(S,St)}$) by baseline manure management system (*S*) and State (*St*)[1] used for derivation of methane emission factors ($EF_{(T,S,St)}$); (percent).

State	Liquid/Slurry and Deep Pit	Anaerobic Lagoon
Alabama	38.5	75.8
Alaska	13.8	48.3
Arizona	53.2	79.3
Arkansas	36.1	75.9
California	37.7	76.2
Colorado	22.2	66.7
Connecticut	23.9	69.4
Delaware	29.7	73.9
Florida	52.2	77.8
Georgia	38.3	75.6
Hawaii	59.7	77.1
Idaho	23.2	68.3
Illinois	26.9	71.5
Indiana	26.0	70.6
Iowa	24.7	69.7
Kansas	31.9	74.5
Kentucky	30.4	73.2
Louisiana	46.1	77.2
Maine	19.5	63.3
Maryland	27.6	72.1
Massachusetts	23.2	68.7
Michigan	22.0	66.7
Minnesota	22.8	67.9
Mississippi	40.1	76.1
Missouri	30.4	73.8
Montana	21.1	65.9
Nebraska	26.7	71.5
Nevada	25.7	70.5
New Hampshire	21.0	65.5
New Jersey	26.4	71.9
New Mexico	32.6	74.4
New York	21.7	66.6
North Carolina	33.7	74.6
North Dakota	21.7	66.9
Ohio	24.8	69.5
Oklahoma	36.5	76.1
Oregon	22.8	67.0
Pennsylvania	25.2	70.4
Rhode Island	24.6	70.4
South Carolina	37.8	75.8
South Dakota	24.2	69.6
Tennessee	32.6	74.2
Texas	41.6	77.0
Utah	26.2	71.1
Vermont	20.2	64.5
Virginia	27.9	72.0
Washington	23.4	67.9
West Virginia	25.3	69.8
Wisconsin	22.4	67.7
Wyoming	21.3	66.0

[1]Data from Table A-165, Appendix 3.10, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004

Table B.6 – Baseline annual GHG emissions for ***liquid slurry/pit storage*** manure management systems (*S*) by livestock category (*T*) and state, assuming $GWP_{Methane}$ = 21 and no solids separation; (metric tons CO_2e per head per year).

State	Dairy Cow	Dairy Heifer	Feedlot Steers	Feedlot Heifers	Market Swine <60 lbs.	Market Swine 60-119 lbs.	Market Swine 120-179 lbs.	Market Swine >180 lbs.	Breeding Swine
Alabama	2.43	1.09	1.09	1.06	0.13	0.21	0.35	0.47	0.49
Alaska	1.12	0.39	0.39	0.38	0.05	0.08	0.12	0.17	0.18
Arizona	4.31	1.51	1.50	1.45	0.18	0.29	0.48	0.64	0.68
Arkansas	2.30	1.13	1.01	0.98	0.13	0.20	0.33	0.44	0.46
California	2.62	1.07	1.06	1.03	0.13	0.21	0.34	0.46	0.48
Colorado	1.43	0.63	0.62	0.60	0.08	0.12	0.20	0.27	0.28
Connecticut	1.50	0.61	0.68	0.66	0.08	0.13	0.22	0.29	0.30
Delaware	1.86	0.76	0.85	0.82	0.10	0.16	0.27	0.36	0.38
Florida	3.29	1.48	1.48	1.44	0.18	0.28	0.47	0.63	0.66
Georgia	2.42	1.08	1.09	1.06	0.13	0.21	0.35	0.46	0.49
Hawaii	4.83	1.69	1.68	1.62	0.21	0.33	0.54	0.72	0.76
Idaho	1.88	0.66	0.65	0.63	0.08	0.13	0.21	0.28	0.29
Illinois	1.70	0.76	0.77	0.74	0.09	0.15	0.24	0.33	0.34
Indiana	1.65	0.74	0.74	0.72	0.09	0.14	0.24	0.31	0.33
Iowa	1.56	0.70	0.70	0.68	0.09	0.13	0.22	0.30	0.31
Kansas	2.05	0.90	0.89	0.87	0.11	0.17	0.29	0.39	0.40
Kentucky	1.92	0.86	0.86	0.84	0.11	0.17	0.28	0.37	0.39
Louisiana	2.93	1.45	1.29	1.25	0.16	0.25	0.42	0.56	0.59
Maine	1.22	0.50	0.56	0.54	0.07	0.11	0.18	0.24	0.25
Maryland	1.73	0.70	0.79	0.76	0.10	0.15	0.25	0.33	0.35
Massachusetts	1.45	0.59	0.66	0.64	0.08	0.13	0.21	0.28	0.29
Michigan	1.39	0.62	0.63	0.61	0.08	0.12	0.20	0.27	0.28
Minnesota	1.44	0.65	0.65	0.63	0.08	0.12	0.21	0.28	0.29
Mississippi	2.53	1.13	1.14	1.10	0.14	0.22	0.36	0.49	0.51
Missouri	1.93	0.86	0.87	0.84	0.11	0.17	0.28	0.37	0.39
Montana	1.36	0.60	0.59	0.57	0.07	0.12	0.19	0.26	0.27
Nebraska	1.72	0.76	0.75	0.72	0.09	0.15	0.24	0.32	0.34
Nevada	2.08	0.73	0.72	0.70	0.09	0.14	0.23	0.31	0.33
New Hampshire	1.31	0.53	0.60	0.58	0.07	0.11	0.19	0.25	0.27
New Jersey	1.65	0.67	0.75	0.73	0.09	0.14	0.24	0.32	0.34
New Mexico	2.64	0.92	0.92	0.89	0.11	0.18	0.30	0.39	0.41
New York	1.36	0.55	0.62	0.60	0.08	0.12	0.20	0.26	0.28
North Carolina	2.12	0.95	0.96	0.93	0.12	0.18	0.31	0.41	0.43
North Dakota	1.40	0.61	0.61	0.59	0.08	0.12	0.20	0.26	0.28
Ohio	1.57	0.70	0.71	0.68	0.09	0.14	0.22	0.30	0.31
Oklahoma	2.32	1.15	1.02	0.99	0.13	0.20	0.33	0.44	0.46
Oregon	1.85	0.65	0.64	0.62	0.08	0.12	0.21	0.28	0.29
Pennsylvania	1.58	0.64	0.72	0.69	0.09	0.14	0.23	0.31	0.32
Rhode Island	1.54	0.63	0.70	0.68	0.09	0.13	0.22	0.30	0.31
South Carolina	2.38	1.07	1.07	1.04	0.13	0.21	0.34	0.46	0.48
South Dakota	1.56	0.68	0.68	0.66	0.08	0.13	0.22	0.29	0.31
Tennessee	2.06	0.92	0.93	0.90	0.11	0.18	0.30	0.39	0.41
Texas	2.65	1.31	1.16	1.13	0.14	0.23	0.38	0.50	0.53
Utah	2.12	0.74	0.74	0.71	0.09	0.14	0.24	0.32	0.33
Vermont	1.26	0.51	0.58	0.56	0.07	0.11	0.18	0.24	0.26
Virginia	1.76	0.79	0.79	0.77	0.10	0.15	0.25	0.34	0.35
Washington	1.89	0.66	0.66	0.64	0.08	0.13	0.21	0.28	0.30
West Virginia	1.58	0.64	0.72	0.70	0.09	0.14	0.23	0.31	0.32
Wisconsin	1.42	0.63	0.64	0.62	0.08	0.12	0.20	0.27	0.28
Wyoming	1.37	0.60	0.60	0.58	0.07	0.12	0.19	0.26	0.27

Table B.7 – Baseline annual GHG emissions for anaerobic lagoon manure management systems (S) by livestock category (T) and state, assuming GWP Methane = 21 and no solids separation; (metric tons CO_{2e} per head per year).

State	Dairy Cow	Dairy Heifer	Feedlot Steers	Feedlot Heifers	Market Swine <60 lbs.	Market Swine 60-119 lbs.	Market Swine 120-179 lbs.	Market Swine >180 lbs.	Breeding Swine
Alabama	4.78	2.15	2.15	2.09	0.26	0.41	0.69	0.92	0.96
Alaska	3.91	1.37	1.36	1.31	0.17	0.26	0.44	0.59	0.61
Arizona	6.42	2.24	2.23	2.16	0.28	0.43	0.72	0.96	1.01
Arkansas	4.83	2.38	2.12	2.06	0.26	0.41	0.69	0.92	0.96
California	5.30	2.16	2.15	2.08	0.26	0.42	0.69	0.92	0.97
Colorado	4.29	1.89	1.87	1.81	0.23	0.36	0.60	0.81	0.85
Connecticut	4.35	1.77	1.98	1.91	0.24	0.38	0.63	0.84	0.88
Delaware	4.63	1.88	2.10	2.04	0.26	0.40	0.67	0.90	0.94
Florida	4.91	2.20	2.21	2.14	0.27	0.42	0.70	0.94	0.99
Georgia	4.77	2.14	2.15	2.08	0.26	0.41	0.68	0.92	0.96
Hawaii	6.24	2.18	2.17	2.10	0.27	0.42	0.70	0.93	0.98
Idaho	5.53	1.93	1.92	1.86	0.24	0.37	0.62	0.83	0.87
Illinois	4.53	2.02	2.04	1.97	0.25	0.39	0.65	0.87	0.91
Indiana	4.47	2.00	2.01	1.95	0.25	0.39	0.64	0.86	0.90
Iowa	4.42	1.97	1.98	1.92	0.24	0.38	0.63	0.84	0.88
Kansas	4.79	2.11	2.09	2.02	0.26	0.41	0.67	0.90	0.95
Kentucky	4.62	2.07	2.08	2.02	0.25	0.40	0.66	0.89	0.93
Louisiana	4.91	2.43	2.16	2.09	0.27	0.42	0.70	0.94	0.98
Maine	3.96	1.61	1.80	1.74	0.22	0.35	0.57	0.77	0.80
Maryland	4.51	1.84	2.05	1.99	0.25	0.39	0.65	0.87	0.91
Massachusetts	4.30	1.75	1.96	1.89	0.24	0.37	0.62	0.83	0.87
Michigan	4.23	1.89	1.90	1.84	0.23	0.36	0.60	0.81	0.85
Minnesota	4.30	1.92	1.93	1.88	0.24	0.37	0.61	0.82	0.86
Mississippi	4.80	2.15	2.16	2.10	0.26	0.42	0.69	0.92	0.97
Missouri	4.68	2.09	2.10	2.04	0.26	0.40	0.67	0.89	0.94
Montana	4.24	1.86	1.85	1.79	0.23	0.36	0.60	0.80	0.84
Nebraska	4.60	2.02	2.01	1.94	0.25	0.39	0.65	0.87	0.91
Nevada	5.70	2.00	1.98	1.92	0.24	0.38	0.64	0.85	0.89
New Hampshire	4.10	1.67	1.86	1.80	0.23	0.36	0.59	0.79	0.83
New Jersey	4.50	1.83	2.05	1.98	0.25	0.39	0.65	0.87	0.91
New Mexico	6.02	2.11	2.09	2.02	0.26	0.41	0.67	0.90	0.94
New York	4.17	1.70	1.90	1.83	0.23	0.36	0.60	0.81	0.85
North Carolina	4.70	2.11	2.12	2.05	0.26	0.41	0.68	0.90	0.95
North Dakota	4.30	1.89	1.88	1.81	0.23	0.37	0.61	0.81	0.85
Ohio	4.40	1.97	1.98	1.92	0.24	0.38	0.63	0.84	0.88
Oklahoma	4.84	2.39	2.13	2.06	0.26	0.42	0.69	0.92	0.97
Oregon	5.42	1.90	1.88	1.82	0.23	0.37	0.61	0.81	0.85
Pennsylvania	4.41	1.79	2.00	1.94	0.24	0.38	0.64	0.85	0.89
Rhode Island	4.41	1.79	2.00	1.94	0.24	0.38	0.64	0.85	0.89
South Carolina	4.78	2.15	2.15	2.09	0.26	0.41	0.69	0.92	0.96
South Dakota	4.48	1.97	1.95	1.89	0.24	0.38	0.63	0.84	0.88
Tennessee	4.68	2.10	2.11	2.04	0.26	0.40	0.67	0.90	0.94
Texas	4.90	2.42	2.15	2.09	0.27	0.42	0.70	0.93	0.98
Utah	5.75	2.01	2.00	1.93	0.25	0.39	0.64	0.86	0.90
Vermont	4.04	1.64	1.84	1.78	0.22	0.35	0.58	0.78	0.82
Virginia	4.54	2.04	2.04	1.98	0.25	0.39	0.65	0.87	0.91
Washington	5.49	1.92	1.91	1.85	0.24	0.37	0.61	0.82	0.86
West Virginia	4.37	1.78	1.99	1.92	0.24	0.38	0.63	0.85	0.89
Wisconsin	4.29	1.92	1.93	1.87	0.23	0.37	0.61	0.82	0.86
Wyoming	4.25	1.87	1.85	1.79	0.23	0.36	0.60	0.80	0.84

Verification of *ex ante* baseline emissions calculation:

Baseline Practice:

The verifier shall confirm through records searches and site inspection the baseline practice at the facility as liquid/slurry, deep pit or anaerobic lagoon.

Flare Efficiency:

For projects wishing to demonstrate combustion efficiency for flared biogas greater than 90%, the verifier shall confirm and document evidence demonstrating the higher efficiency.

Calculation:

In order to verify the correctness of the calculation, the verifier shall confirm average livestock populations for the reporting period through a document search; confirm the use of the appropriate emission factor by state or country, solid separation factor, manure proportion and number of days in the period. Further the verifier shall confirm the appropriate use of the solid separation correction factor in the calculation.

References

DOE 2007, Technical Guidelines, Voluntary Reporting of Greenhouse Gases (1605(b)) Program (January 2007) [http://www.pi.energy.gov/pdf/library/Track_Changes_CorrectedTechnicalGuidelines1_29_07.doc]

IPCC 2000, Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (May 2000)
[http://www.ipcc-nggip.iges.or.jp/public/gp/english/]

IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Chpt. 10: Livestock Emissions) [http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_10_Ch10_Livestock.pdf]

ISO 2006. Greenhouse Gases – Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements (ISO 14064-2). [http://www.iso.ch/iso/en/commcentre/pressreleases/2006/Ref994.html]

UNFCCC CDM. Approved small-scale methodology III.D. Methane recovery in agricultural and agro-industrial industries (version 10).
[http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_LM875Z64MVHWOE3JVL4BGGIC4SRUBE]

US EPA 2006. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004.

US EPA 2007. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005. [http://www.epa.gov/climatechange/emissions/usinventoryreport.html]

US EPA 2006. EPA Climate Leaders Draft Offset Protocol, Project Type: Managing Manure with Biogas Recovery Systems (October 2006) [http://epa.gov/climateleaders/docs/ClimateLeaders_DraftManureOffsetProtocol.pdf]

WRI/WBCSD 2005. The GHG Protocol for Project Accounting. World Resources Institute/World Business Council for Sustainable Development, November, 2005.
[http://www.ghgprotocol.org/templates/GHG5/layout.asp?type=p&MenuId=OTAy]

Appendix 9.1 C Protocol for Measuring, Recording, and Verifying Coal Mine Methane Capture and Use

I. Introduction

Methane, a potent greenhouse gas, is contained in coal seams throughout the United States (U.S.). Currently in the U.S., coal mines account for approximately 10 percent of all manmade methane emissions. Methane presents a safety hazard for operators of gassy mines because it is explosive at concentrations from 5 to 15 percent in air. Gassy underground coal mines are designed and operated in such a way that methane liberated during the extraction of coal is removed from the mine through powerful *ventilation* fans, which are part of a system that ensures safe working conditions in the mine. For particularly gassy mines, operators may employ additional methane *drainage* systems to supplement their ventilation systems in order to maintain a safe working environment.

Gas may be recovered and pumped to the surface in the process of removing gas via an underground drainage system, but utilization of recovered methane is not currently a typical operational practice at underground coal mines. Methane is most often vented to the atmosphere. Methane is the principle component of natural gas, and gas that is recovered from coal mines of sufficiently high methane concentrations can be used for its energy content. Because of this, any coal mine methane (CMM) captured by active mines or abandoned mines could be used in the same way as natural gas (e.g., through pipeline injection of high-quality gas or as fuel for electricity generation from mid-quality gas). Companies that engage in such project activities can prevent methane from being emitted to the atmosphere.

The purpose of this protocol is to address the measurement and verification of methane emission reductions resulting from the utilization of CMM and abandoned mine methane (AMM) gas for the Chicago Climate Exchange (CCX).

II. Definitions

Abandoned mine methane (AMM): Methane that is produced from coal mines designated as abandoned according to U. S. Mine Safety and Health Administration (MSHA) or equivalent non-U.S. mining regulatory agency rules.

Coalbed methane (CBM): Methane that resides within coal seams. For the purposes of this protocol, coalbed methane refers to methane produced from coal seams unrelated to mining activities.

Coal mine methane (CMM): As coal mining proceeds, methane contained in the coal and surrounding strata may be released. This methane is referred to as coal mine methane since its liberation resulted from mining activity. In some instances, methane that continues to be released from the coal-bearing strata once a mine is closed and sealed may also be referred to as coal mine methane (or abandoned mine methane) because the liberated methane is associated with past coal mining activity.

Gob: A fractured rubble zone behind the mining face that is caused by the removal of the coal and the subsequent collapse of the mine roof and heaving of the mine floor.

Mine gas: The post-mine drainage gas that contains CMM but also contains various levels of other components, such as nitrogen, oxygen, carbon dioxide, hydrogen sulfide, and heavier hydrocarbons.

Mine Safety and Health Administration (MSHA): Federal enforcement agency responsible for the health and safety of U.S. miners.

Pre-mining drainage: Methane extraction from vertical surface wells (CBM) or horizontal underground boreholes in the mine prior to mining activities. This methane would have been emitted during mining activities had it not been previously drained. When CBM wells are mined around or through, the previously extracted methane is then considered CMM that has been captured and used.

Post-mining drainage: Methane extraction after completion of the mining process from vertical surface gob wells, underground inclined or horizontal boreholes, gas drainage galleries, or other gob gas capture techniques, including drainage of sealed areas in the mine (for safety reasons).

Ventilation air methane (VAM): CMM that is mixed with the ventilation air in the mine that is circulated in sufficient quantity to dilute the methane to low concentrations (typically below 1 percent) for safety reasons.

III. <u>Applicability</u>

This protocol applies to methane liberated as a result of coal mining activities (CMM) from either active or abandoned coal mines as defined by MSHA or equivalent non-U.S. mining regulatory agencies. Active coal mines include mine works that continue to be actively ventilated by the coal mine operator. This could also include MSHA designated "non-producing" or "idle" coal mines. Abandoned coal mines are declared "abandoned" from the date when ventilation activities cease to exist.

This protocol applies to methane recovered from active and abandoned coal mines using the following extraction techniques:

- Pre-mining drainage wells (from the surface or underground) associated with mining activities at active coal mines;
- Post-mining drainage wells (from the surface or underground) associated with mining activities including from sealed mine areas; and

- Ventilation air methane from ventilation fans.

IV. Eligibility

To be eligible, any methane-extraction technique used at active coal mines must be approved for use by MSHA or equivalent non-U.S. mining regulatory agency rules. CCX eligibility requirements for methane to be included for registration are as follows:

- Methane produced from pre-drainage wells will be limited to wells drilled after January 1, 1999.
- Methane produced from pre-drainage wells will only be eligible after the well is mined around or through.
- All methane produced from pre-drainage wells from within a -50 meter to +150 meter vertical range of the mined coal seam will become eligible when the well is mined around or through.
- Methane produced outside the established vertical range can become eligible if the candidate project(s) demonstrate sufficient analytical evidence, consistent with IPCC Tier 3 Methodology, which connects methane generated outside the established vertical range to the mined seam in question.
- All methane produced from abandoned coal mines will be eligible.

CCX requirements for crediting methane recovery from coal mines as *emission offsets* include the following:

Phase II registration & trading

- **Pre-Mining Activities:**
  - CMM collected from wells drilled after January 1, 1999, and mined around or through after January 1, 2007, can be registered and traded on CCX.
- **Post-Mining Activities:**
  - CMM from any wells drilled *after* January 1, 1999, and collected after January 1, 2003,can be registered and traded on the CCX.
  - CMM from any well drilled *prior* to January 1, 1999 and collected after January 1, 2003, which is: 1) processed/refined through a low quality gas facility, constructed after January 1, 1999, or 2) utilized in a low quality combustion process (i.e. reciprocating engine, boiler, flare), constructed after January 1, 1999, can be registered and traded on the CCX.
  - CMM from any well drilled *prior* to January 1, 1999 and collected after January 1, 2003, which is not 1) processed/refined through a low quality gas facility, constructed after January 1, 1999, or 2) utilized in a low quality combustion process (i.e. reciprocating engine, boiler, flare), constructed after January 1, 1999, cannot be registered and traded on the CCX.

V. Protocol for Measuring, Recording, and Verifying Methane Capture and Use

The purpose of this protocol is to establish a methodology to accurately determine the amount of methane captured and utilized and/or sold in a coal mine methane emission reduction project. The methane may be used at numerous locations within a project from compressors used to bring the gas from underground to the surface at individual well bores. It may also be used in intermediate compression sites that gather gas from several different sources such as wells or mines which then ship the gas to a sales point or various end use facilities such as boilers, power generators or simple flares. Wherever there is a change in flow volume related to usage or gas composition related to the blending of different gas streams there must be measurement devices to determine the quantity of methane from that point to the next downstream device. Because methane is the valued product the accounting of this product must meet commercial standards similar to those used in the natural gas industry.

The measuring and recording system should be setup such that there is a "master meter" from which various flow streams can be allocated. This will allow quality checking of the other meters on the system and also allow volumes to be calculated in the case of a measuring device being out of service or not functioning properly for a period of time. This master meter should have some type of continuous monitoring and data accumulation of the total gas volume and the methane concentration of the gas over given period of time. Spot sampling (as opposed to continuous monitoring) of the methane content from locations upstream of the master meter can be conducted for use in allocating the methane destroyed to the various end use devices both upstream and downstream of the master meter location.

CCX members shall employ the emission monitoring, reporting methods, and procedures described in this section. The prescribed emissions monitoring methods are based on the calculation tools contained in the World Resources Institute's "*Corporate GHG Accounting and Reporting: Corporate Inventory Module*" and/or the United Nations Framework Convention on Climate Change consolidated methodology (*ACM0008*) developed for CMM projects.

Methane capture and utilization (or destruction) amounts are determined primarily by the measurement of gas flow rates, methane concentration, and combustion efficiencies of end-utilization technologies. Measurements of additional parameters, such as gas sales, electricity production, and gas composition, are also required. Because this methodology applies to CMM recovered from both drained mine gas and VAM from active mines, as well as AMM from abandoned mines, the measurement protocols applied may require different levels of rigor depending on the source of the gas and the number of end uses.

All natural gas measurements shall be performed within the protocols established by the American Gas Association (AGA), or similar international protocols, and documented in report number 3 (Orifice Metering of Natural Gas) and report number 8 (Compressibility Factors of Natural Gas), or equivalent formats. It is anticipated that the majority of equipment used to measure natural gas flow will be orifice meters complete with electronic flow measurement computers (EFM), and on-line methanometers, which record methane concentrations in conjunction with the EFM. Other methods such as physical sampling and gas chromatograph analysis may also be used for determining methane concentration over time intervals of interest.

A. Carbon Offset Conversion Factors

The standard CCX carbon offset conversion factor of 18.25 shall be applied to all CMM projects, regardless of end utilization. This includes, but is not limited to the following types of CMM projects: gas sales to pipelines or local industry, electric and thermal power generation, gas boilers, liquefied or compressed gas, or gas flaring,

B. CMM Flow Rate Measurements

Equipment

The most common types of flow meters measure gas flow by sensing differential pressure. CCX recommends that gas flow through a pipe should be performed by AGA (or equivalent) methodologies using an orifice plate and recording temperature and pressure differential. These flow meters measure flow using a standard mathematical formula without the need to modify the result based on proprietary device-specific information. Most EFMs will have an instantaneous flow read out and will save the data in a non-volatile memory, or the flow meter may be read using the flow readout device on the flow computer.

The flow meter should be installed in accordance with AGA report number 3 along a straight section of pipe sufficient to establish laminar gas flow, because turbulent flow resulting from bends, obstructions, or constrictions in the pipe can cause interference with flow measurements (which rely on differential pressure across an orifice plate).

Because VAM flows through ductwork and not pressurized pipe, VAM flow measurement will require an alternative measurement method and different types of equipment. CCX will include VAM-specific guidelines in the future.

Performance Standard

The following information regarding flow-meter performance must be maintained and are required by CCX to be included in Project Reports:

- Manufacturer specifications of flow-meter accuracy should be +/-2% of reading;
- Proof of initial calibration;
- Capability to record flow every 15 minutes; and
- Means to correct for temperature and pressure.

Instrument Maintenance and Periodic Check of Flow Meter Accuracy

Installed flow meters should be inspected, cleaned, and checked quarterly for accuracy (or as prescribed by the instrument manufacturer). The flow accuracy should be checked using an alternative, portable instrument (such as a pitot tube) to measure the flow velocities along a traverse of the header pipe. The velocity measurements are then used to calculate a flow rate, which is typically accurate to within 2 percent in larger pipes (greater than 4 inches in diameter).

Frequency of Recording

Gas-flow measurements of CMM must be recorded continuously. This is a standard operating procedure when using an EFM

Recordkeeping

The following records of CMM flowing to the end utilization/destruction are to be kept in order to verify methane emissions reductions:

- Name of CMM project;
- Type of flow meter;
- Date and location of flow meter installation;
- Dates and results of flow meter calibration;
- Copies of charts or diskettes on which flow rates were recorded;
- Monthly tabulations of unadjusted total daily gas flow to the control device (in actual cubic feet per day);
- Copies of field data used for flow measurement calibration;
- Monthly tabulations of daily mine gas flow rate standardization calculations and results (in standard cubic feet per day);
- Monthly tabulations of number of hours end utilization/destruction was shut down[28];
- Information on the portable instrument and procedures used to check the installed flow-meter accuracy, including field measurements and flow calculations; and
- Records of third-party verification of flow measurements and procedures.

The above-listed records need to be kept readily accessible and on-site (or with the local field office responsible for the site) for at least 2 years after the date that annual methane emissions reductions for the site have been recorded at the CCX. These records may be required in Project Reports by CCX.

C. Methane Concentration Measurements

Equipment

A methanometer or gas chromatograph is acceptable for measuring CMM. An online methanometer or gas chromatograph can be used in conjunction with an EFM to accurately calculate the methane volume of the CMM.

[28] No offsets will be issued by CCX for periods during which the methane utilization/destruction equipment is not operated and methane was vented to the atmosphere.

For smaller CMM projects where online methanometers may not be justified, methane concentration measurements can be taken directly by connecting the sampling tube to a sampling port in the pipeline and using a hand-held methanometer. Alternatively, the gas sample can be collected in a Tedlar bag or Summa canister or any other AGA- or EPA-approved sampling method and then sent to an approved lab for testing.

Downstream of compression equipment, collection systems can be installed that physically accumulate small samples of gas in a pressure canister every few minutes for a period of time (e.g. month). The resulting gas volume will represent the methane content of the gas for that time period. This gas can be analyzed with a gas chromatograph so that other components of the gas can be determined.

Because methane concentrations in VAM flows range from 0.1 – 1.0 percent, measurements of methane concentrations will require an alternative measurement method and different types of equipment. CCX will include VAM-specific guidelines in the future.

Performance Standards

The following performance standards are recommended for current measurements for the calculation basis of Exchange Methane Offsets:

- Precision: Methane measurements are to be to the nearest 0.1 percent (weight or volume).
- Accuracy: Methane measurement accuracy decreases with increasing methane concentration but should be within +/- 2.0 percent of reading for on-line equipment, and within +/- 5.0 percent for hand-held devices. Alternate instruments, including gas chromatographs or thermal conductivity detectors, must meet similar standards.

Instrument Calibration Procedures

For portable units, the gas analyzer instrument shall be calibrated against a gas sample with a known methane concentration prior to each day of use. Online gas chromatographs shall be calibrated according to AGA procedures or the manufacturer's calibration procedures, including instrument adjustments. A calibration gas with a methane concentration close to the concentration expected in the field (i.e., 40 to 90 percent methane) is optimal.

Frequency of Recording

If an online chromatograph is used, methane concentrations shall must be measured and recorded daily. Methane concentration measurements taken of CMM gas samples using a gas chromatograph or handheld meter shall be conducted daily for active mine CMM projects where the gas composition is subject to constant variation. If methane variation is demonstrated to be less than $\pm$2 percent, CCX will accept weekly methane concentration measurements. For AMM projects where the methane concentrations typically remain relatively stable, CCX will accept measurement intervals no greater than monthly.

Recordkeeping

The following records of measured methane concentrations are to be kept in order to verify the methane emissions reductions:

- Name of CMM project;
- Type of instrument;
- Dates and results of instrument calibration;
- Dates and results of methane measurement;
- Monthly tabulations of measured methane concentrations; and
- Records of third-party verification of methane measurements and procedures.

The above-listed records need to be kept readily accessible and on-site for at least 2 years after the date that annual emissions reductions for the site have been registered with CCX and may be required by CCX to be included in Project Reports.

D. Integrated Flow and Concentration Measurements

Although not required, CCX recommends the use of integrated flow and concentration meters for use with larger, long-term CMM offset projects. The integrated flow and concentration metering system is composed of three units: (1) a methane analyzer to determine the concentration of methane in the mine gas stream, (2) a flow meter that is temperature and pressure compensated to measure the flow rate of mine gas at standard conditions, and (3) a flow data processor to compute the mass flow rate of methane and to integrate the flow rate over time to yield a cumulative mass flow rate of methane between two points of time.

The integrated methane flow and concentration meters provide a cumulative measure of the quantity of methane that has passed through the meter, in units of metric tons. A flow metering system includes the capability to download the continuous methane flow measurements on computers or data storage devices such as CD-ROMs.

E. Measurement Locations

A master meter with continuous methane concentration data accumulation combined with volumetric flow should be placed upstream of the final end use devices or gas sales point. The methane content of the gas downstream of this meter will not change before it is used in any of the end use devices. The total gas volume and destruction efficiency of the end use device will therefore determine the volume of the methane destroyed. Sampling of the methane content of the gas upstream of the master meter will allow the back allocation of the methane destroyed to devices using the CMM prior to the master meter.

Flow Meters

If a CMM blower (suction pump) or other compression equipment is being powered by the CMM, there should be a flow meter upstream and downstream of the blower such that the methane concentration can be recorded at one of those locations and the destruction of the methane documented. A fuel meter may be installed at the pump or compressor in lieu of the upstream full gas flow meters.

A single flow meter is acceptable for gas being sent to multiple-end uses providing they are of the same equipment type. For example, if the CMM pipeline is manifold to reach a set of multiple gas-fired electric gensets, only one flow meter is required. The methane content of the gas being measured by the flow meter must be known either upstream or downstream of that meter.

If the CMM is sent to various end uses, such as gas boilers, electric gensets, and flares, a separate flow meter should be installed upstream of each device with the methane content of the gas measured by the flow meter known. If CMM is being sold and used off-site, a flow meter should be installed at the exit or gas sales point.

Methane Concentration

A recovery project may draw from more than one coal mine or different areas of a coal mine with differing methane concentrations. A separate flow meter and methane concentration measurement can be taken from each CMM source before the gas is blended together for project management purposes, but this is not required for documenting methane destruction. The methane concentration and flow rate of any CMM must be known before it is combusted by on-site equipment, such as blowers or compressors, which are located upstream of the ultimate end-utilization technology. Methane concentrations must be taken again before the end-utilization equipment if a side-stream of gas is blended with the gas downstream of methane utilization by on site equipment

.

Example Locations

Figure 1 shows the appropriate locations for monitoring and measuring gas flow and methane concentrations as described above. The example uses three different type end-use technologies as well as recovering methane from two coal mines, one active and one abandoned.

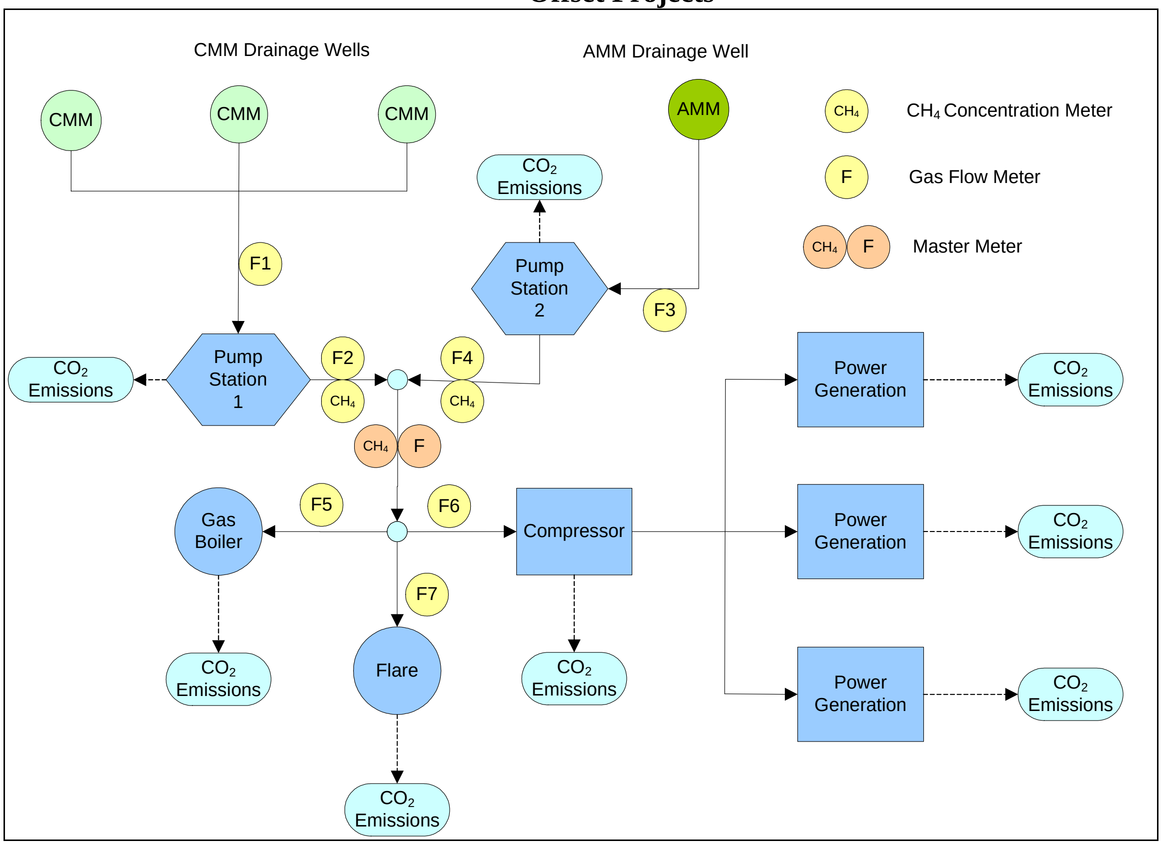
Using Figure 1 as an example, it can be seen that the difference in volume between F1 and F2 multiplied by the fraction of methane in the gas downstream of pump station 1 will be the methane used at pump station 1. It can also be seen that the sum of the volume of methane at F2 and F4 should equal the methane at the master meter. Because the master meter has the most rigorous measurement and calibration standards it is considered to be the true volume of methane at that point. Using the following formulas an allocation factor can be determined.

Allocation Factor = CH_4 volume at the master meter ÷ (F2 X %CH_4 + F4 X %CH_4)

This allocation factor multiplied by the methane volumes at the upstream measuring points will more accurately assign methane volumes to the upstream utilization devices. This is standard practice in oil and gas fields where well flow rates are measured only periodically. Allocation schemes also provide a quality check of the measurement devices throughout the system. A large allocation factor indicates a problem either with the master meter of with meters elsewhere in the system.

The master meter can also be used to allocate volumes to downstream devices. For example in Figure 1 the meters F5, F6 and F7 should sum to the master meter. The ratio of the master meter to the sum of these meters will provide an allocation factor to or accurately apportion the methane to the various end uses shown.

Figure 1 – Location of Monitoring Equipment to be Used by CCX Member CMM/AMM Emission Offset Projects



Missing Data Contingency Plans

Typically, flow meters are extremely reliable and also the least expensive unit in the monitoring metering system. Since there may not be a convenient back-up flow measurement alternative of equal accuracy, it is recommended that a spare flow meter be kept in the mine inventory at all times. Replacement of the unit is quick and easy, requiring the temporary shutdown of the pipeline flow. Because the pipeline is shut down during replacement, there will be a negligible amount of unmeasured methane flow.

Alternative 1:

However, should a flow meter fail and a spare unit not be available, other flow meters (if located on the same CMM pipeline network) could be temporarily used to calculate the failed unit's gas flow. Using the master meter and other meters in system as shown in Figure 1 the methane flow at the failed location can be calculated until a replacement can be installed.

Alternative 2:

Energy recovery facilities that use CMM as a fuel to generate electricity should keep detailed records of electrical generation rates in kilowatt-hours (kW-hr) over time, so that they can be used to calculate methane combustion rates. Information on the heat rate of the combustion unit in BTUs/kW-hr can be used to calculate BTUs of combusted methane. Typically, the high heating value of methane (1,012 BTUs per cubic foot) is used to convert to a methane flow rate. The calculation can be summarized using the following equation[29]:

Methane recovery (ft^3) = [kW-hr of electricity produced from the CMM fuel] x [heat rate in BTU/kW-hr] / [1012 BTU/ft^3 (HHV of methane)]

The heat rate used in the calculation should be from the most recent source test for the combustion device. If no source test information is available, the heat rate per the manufacturer's specifications should be used.

Gas consumed by compression units used throughout the project can be calculated in a similar manner based on the performance specifications of the equipment and run-time. The following information regarding the measurement of methane combustion from methane-fueled equipment must be maintained and may be required by CCX to be included in the Project Reports:

- Type, make, and model number of combustion unit(s);
- Number of combustion units that exclusively use CMM as fuel;
- Heat rate of combustion device(s) per manufacturer's specifications;
- Copy of a summary table from the most recent source test showing the measured heat rate of combustion device(s);
- Summary tables showing kW-hr of electricity produced (or thermal energy) from CMM per month over the annual period;
- Type of electrical metering device; and
- Accuracy, precision, and calibration information on the metering device per manufacturer.

The above-listed records need to be kept readily accessible and on-site for at least 2 years after the date that annual methane emissions reductions for the site have been recorded at the CCX and may be required by CCX to be included in Project Reports.

[29] Assumes no other hydrocarbons present in gas stream. NMHCs need to be accounted for as addressed in Section J.

F. Electrical Output Measurements

It is a common practice for electrical generator manufacturers to provide watt meters on their units. These meters report the total quantity of electricity generated in units of kW-hr. The watt meters, usually provided as standard equipment of engine-electrical generator sets, have accuracies of no less than +/-1 percent. The manufacturers use solid-state watt meters that are calibrated at the factory and do not require recalibration during their normal life. However, if a watt meter fails, they are not considered repairable and are normally replaced. The generator manufacturers keep replacement meters in stock and can ship them immediately via express shipping services. Replacement of a failed meter is a simple operation that does not require special tools or skills and can be performed by mine staff.

The electrical output of each generator will be monitored each day. Any time that the electricity production is abnormal, with respect to the quantity of the gas that has been consumed during the same period, it should be reported to the manager responsible for the project. During any period when a watt meter is temporarily out of service, the electricity production can be calculated using the following equation that is based on the assumption that the thermal efficiency of the engine is constant over the period of the missing electrical data:

$$GEN_y = M_{ELEC\text{-}y} \times GEN_m / M_{ELEC\text{-}m}$$

where:

- GEN_y = electricity produced during the period of missing data
- $M_{ELEC\text{-}y}$ = gas consumed by the engine during the period of missing data
- GEN_m = electricity produced by the engine during a past month
- $M_{ELEC\text{-}m}$ = gas consumed by the engine during a past month

G. Gas Sales Measurements

Equipment

Gas flow meters (EFMs) and BTU analyzers (online chromatographs) are typically used as gas sales meters by the gas industry. Typically, these devices operate continuously throughout the life of a project. When BTU analyzers are used in lieu of methanometers, additional gas composition analyses should be periodically performed to determine the methane portion of the gas sales.

Often, mine gas can contain 1 to 2 percent non-methane hydrocarbons (NMHCs), which will affect the BTU recordings at the sales meter. NMHCs are not considered to be greenhouse gases; thus, their volume needs to be backed out of the gas sales to verify the amount of methane gas sold. Section J of this document addresses the measuring of NMHCs.

Performance Standards

Equipment must meet performance standards defined by the American Petroleum Institute, the AGA, or other gas industry regulation for interstate sales of natural gas for the calculation basis of Exchange Methane Offsets:

- Precision: Methane measurements are to be to the nearest 0.1 percent.
- Accuracy: Methane measurement accuracy decreases with increasing methane concentration but should be within +/- 2 percent of reading, as specified by the manufacturer. Alternate instruments, including gas chromatographs or thermal conductivity detectors, must meet similar standards.

Instrument Calibration Procedures

CCX members will follow the manufacturer's details on the calibration procedures, including instrument adjustments.

Frequency of Recording

Gas sales contracts generally require continuous measurement of gas flow and BTU concentrations.

Recordkeeping

The following records of measured methane concentrations are to be kept in order to verify methane emissions reductions:

- Name of CMM project,
- Type of instrument,
- Dates and results of instrument calibration,
- Dates and results of methane measurement,
- Monthly tabulations of measured methane concentrations, and
- Records of third-party verification of methane measurements and procedures.

The above-listed records need to be kept readily accessible and on-site for at least 2 years after the date that annual emissions reductions for the site have been registered with CCX and may be required by CCX to be included in Project Reports.

H. Flaring of CMM

The flaring of CMM requires monitoring and measurements different from those of end-utilization technologies. Because no electrical output or gas sales are recorded, flame detectors and run-time meters are necessary to validate the methane's destruction. The flares will be equipped with flame detectors and run-time meters that document the temperature conditions in the flare. During proper operation, the temperature of the enclosed flare will be between 750 and 1,000 ^{o}C.

Flame Detector

A simple and reliable flame detector for this application is a thermocouple. Thermocouples are manufactured by various companies, with typical accuracies of +/- 2 ^{o} C, or less. Thermocouples have no moving parts and are expected to perform reliably for many years. They are calibrated at the factory and do not require recalibration or maintenance. If a thermocouple fails, a replacement can be obtained quickly. Numerous suppliers keep replacement thermocouples in stock and can ship them immediately through express shipping services.

Runtime Meters

A simple and reliable run-time meter offered by many enclosed flare manufacturers is typically a strip chart recorder. Open flares may need to have the equipment installed in the field. These types of recorders are manufactured by many companies and are low cost meters. A thermocouple connected to a data-recording device could serve the needs of both a flame detector and run-time meter. The data recorder records the thermocouple temperature, the time, and the date. Most models can record data from every 5 seconds to daily. CCX recommends that run-time is recorded every hour or less.

Flame Detector and Runtime Measurements

The flame detector and run-time recorder will provide a continuous verification that the flare temperature is between 750 and 1,000 ^{o} C whenever gas is being sent to the flare. Once each day, the flare chart recorder should be monitored for proper operation and the temperature entered into the data sheet. Whenever the flame temperature is outside of the specifications provided by the flare manufacturer, the incident should be reported to the manager responsible for the project.

The flare temperature charts produced by the chart recorder should be collected monthly and labeled on the chart with the following information:

- Name of CMM project,
- Identification number of the flare,
- Initial time and date of the chart record
- Final time and date of the chart record,
- Name of the person collecting the chart, and
- Records of third-party verification of gas flow and methane measurements and procedures.

The above-listed records need to be kept readily accessible and on-site for at least 2 years after the date that annual methane emissions reductions for the site have been recorded at the CCX. The CCX may require these records to be included in Project Reports.

I. Thermal Destruction/Combustion of VAM

CCX will include VAM-specific guidelines regarding the destruction and/or combustion of methane in the future.

J. Annual Measurement of Non-Methane Hydrocarbon Content

Two sets of data must be documented in association with the measurement of the non-methane hydrocarbons in the mine gas. One set of data relates to the activities involved with collecting the gas sample, and the other set of data relates to the activities involved with conducting the analysis of the gas sample. These two data-collection activities have been separated, since the sampling activities may be conducted by the project developer staff and the analysis activities by a local laboratory. (The same procedure applies to CMM samples sent off-site for analysis). Samples of the sales gas and measurements of the non-methane hydrocarbon should be conducted quarterly[30] for the first year of the project, and annually thereafter. Should the NMHCs volume of the sales gas remain below 1 percent, no adjustment is required to the methane volumes. The sample collection sheet will contain the following information:

Project Sample Collection Sheet:

- Name of CMM project,
- Specific location where a sample is taken,
- Date and time a sample is collected,
- Quantity of samples collected,
- Method of transferring sample to container and type of container,
- Identification number of sample container, and
- Date the sample container was shipped to analytical laboratory.

The analytical report produced by the laboratory analyzing the gas sample must contain the information listed below for the "sample analysis report." In addition, the analytical laboratory should submit a current year copy of their ISO 17025 certification.

Analytical Laboratory Report:

- Name of CMM project,
- Name and address of the analytical laboratory,
- Name of CMM project providing the sample,
- Identification number of sample container,
- Date and time sample arrived at the laboratory and analyzed,
- Type of instrument used to analyze the sample,
- Method used to perform the analysis, and
- Concentration of non-methane hydrocarbons in the sample.

[30] UNFCCC's ACM0008 (Consolidated baseline methodology for CMM/CBM capture and use)

K. Data Variables and Monitoring Equipment Summary Tables

The data variables required for each project activity are listed in **Table 1**.

Table 1. Summary of Measured Data Variables

Data Variable	Units	Recording Frequency	Portion Monitored	Archiving	Archiving Period	Comments
Methane sent to flare	tCH_4	Continuous	100%	Electronic	CP +2yr	Flow meters will record gas volumes, pressure, and temperature. Density of methane under normal conditions of temperature and pressure is 0.68kg/m3
Flare/combustion efficiency, determined by (1) the operation hours	%	(1)Continuous	n/a	Electronic		(1) The flare operation shall be continuously monitored by continuous measurement of operation time of flare using a run-time meter connected to a flame detector or a flame continuous temperature controller.
CMM sent to power plant	tCH_4	Continuous	100%	Electronic	CP +2yr	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.68kg/m3
CMM sent to Boiler	tCH_4	Continuous	100%	Electronic	CP +2yr	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.68kg/m3
Mine gas sent to gas grid for end users	tCH_4	Continuous	100%	Electronic	CP +2yr	Flow meters will record gas volumes, pressure, and temperature. Density of methane under normal conditions of temperature and pressure is 0.68kg/m3.
Concentration of methane in extracted gas	%	Hourly/Daily	100%		CP +2yr	Obtained from same location as flow measurements.
NMHC concentration in coal mine gas	%	Annually	100%		CP +2yr	If below 1% of emissions, no adjustment required.
Mine gas measured sent to use i.	tCH_4	Continuous	100%	Electronic	CP +2yr	Obtained from same location as flow measurements.
Efficiency of methane destruction /oxidation through use of VAM unit.	%	Ex-ante or ex-post	100%	Electronic	CP +2yr	(1) The VAM oxidizer operation shall be continuously monitored by continuous measurement of operation time using a time meter connected to a temperature controller. (2) Periodic measurement of methane content of flare exhaust gas.
Electricity generation by project	MWh	Continuous	100%	Electronic	CP +2yr	Manufacturer provided meter
Heat generation by Project	GJ	Continuous	100%	Electronic	CP +2yr	Manufacturer provided meter

Table 2 shows a summary of monitoring equipment to be used by CCX Offset members for measuring CMM reductions.

Table 2. Summary of Monitoring Equipment

Data Variable Monitored	Monitoring Equipment
Methane sent to flare	Flow and Concentration Meters
Flare/combustion efficiency, determined by operation hours	Flame Detector and Runtime Meters

Methane sent to power plant	Flow and Concentration Meters
Methane sent to boiler	Flow and Concentration Meters
Methane sent to gas grid for end users	Flow and Concentration Meters
Concentration of methane in extracted gas	Flow and Concentration Meters
NMHC concentration in coal mine gas	Annual Measurement of Non-methane Hydrocarbon Content
Methane measured sent to use i.	Flow and Concentration Meters
Efficiency of methane destruction /oxidation of VAM	Temperature Detector and Runtime Meters
Post-mining CMM captured, and destroyed	Flow and Concentration Meters
Electricity generation by project	Electrical Output Meters

VI. Use of Measured Data and Factors to Calculate Emission Offsets

Tabulated records of total daily CMM flows in standard cubic feet per day (scfd) need to be matched against methane concentrations measured during the corresponding time period to determine daily methane recovery rates, using the following equation:

CH_4 recovered (scfd) = mine gas recovered (scfd) x %CH_4

The methane value used in the calculation should be the measurement that is the closest available in time to the date of the flow measurement. Daily methane flows should be tabulated and summed on a monthly basis. Total annual methane recovery from the CMM project is to be tabulated using the monthly summaries of methane recovery.

In order to estimate the amount of methane combusted (or sold to the grid) in metric tons per year (Mg/yr), the annual methane recovery rate in cubic feet per year needs to be converted to weight using the following equation:

CH_4 combusted (Mg/yr) = [CH_4 recovery (ft^3/yr)] x 16.04 (molecular weight of CH_4) x 1Mg/10^6 g* 1mol/24.04L @ STP x 28.32L/1cf x 98.75% (destruction efficiency)

VII. Third Party Verification Requirements

Verification of CMM projects shall be conducted in accordance with the provisions contained in Chapter 9 and 10 of the CCX Rulebook and as prescribed by the CCX Committee on Offsets.

VIII. Verification Checklist for Offset Members

- Confirm eligibility
  - Coal mine background information
    - Dates opened/closed
  - Historical methane recovery

        - Annual amounts
    - Well deployment dates
        - API permit #
        - Well completion reports
    - Pre-drainage wells
        - Methane produced *within* the accepted zone of influence (-50 to + 150 meters from mined coal seam)
        - If larger zone of influence can be demonstrated, include copies of studies showing analytical evidence that methane contained in coal seams or strata outside the accepted zone of influence contributes to emissions at the coal mine
- Measuring and monitoring protocol
    - List measured data and documentation to be verified by auditor
        - Sample of daily recordings
        - Company QA/QC procedures
        - Monthly summaries
        - Supplemental data such as lab analysis (CH4 concentration) or equipment testing
- Calculating emission reductions
    - List and reference assumptions and conversion factors used
    - Sample calculations
    - Spreadsheet
    - QA/QC procedures
- Annual Report
    - Cumulative methane flow from monthly summaries
    - Cumulative gas or electricity sales
    - Proof that equipment performance standards are met
    - Gas composition analysis
    - Proof of equipment calibrations

Appendix 9.2Ai CCX Carbon Accumulation Tables for Afforestation Offset Projects
Section 1: Classification of Afforestation Regions

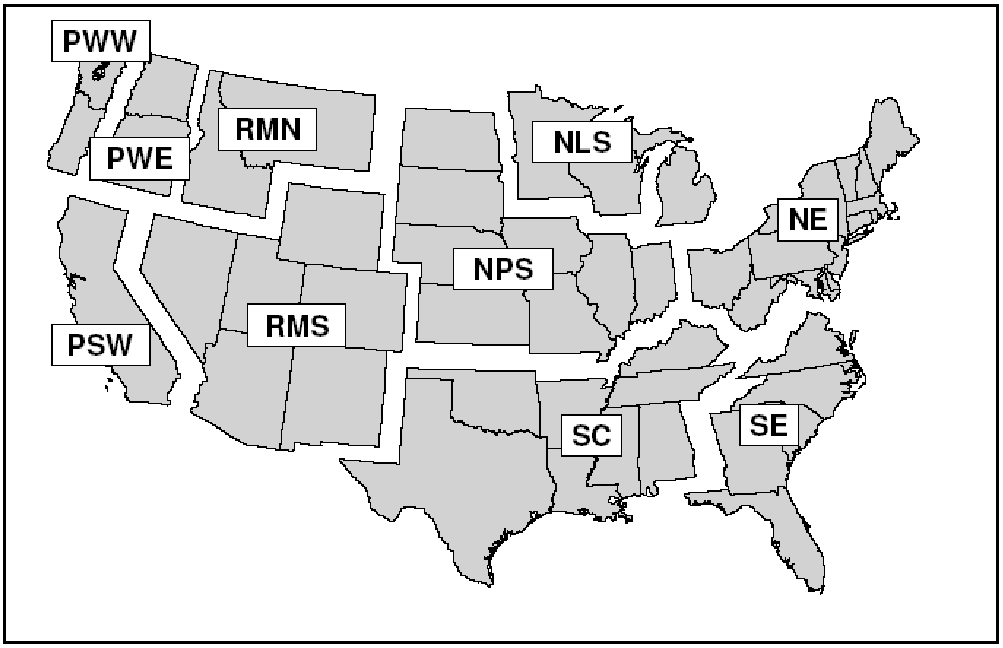


Figure 1.1—Definition of regions: Pacific Northwest, West (PWW); Pacific Northwest, East (PWE); Pacific Southwest (PSW); Rocky Mountain, North (RMN); Rocky Mountain, South (RMS); Northern Prairie States (NPS); Northern Lake States (NLS); Northeast (NE); South Central (SC); and Southeast (SE). Note that regions are merged for some tables, these combinations include: NLS and NPS as North Central; PWW, PWE, and PSW as Pacific Coast; RMN and RMS as Rocky Mountain; SC and SE as South; and RMN, RMS, PWE, and PSW as West (except where stated otherwise).

Section 2: Regional Estimates of Tree Annual Carbon Accumulation in Live trees and Soil Organic Carbon for Afforestation (Metric tons CO_2/ acre/ year age of tree)

Region	Species	1 through 5	6 through 10	11 through 15	16 through 20	21 through 25	26 through 30
Northeast	Aspen-birch	1.424	1.628	1.706	1.852	1.852	1.883
Northeast	Maple-beech-birch	1.571	2.199	2.702	2.638	2.481	2.449
Northeast	Oak-hickory	1.467	2.718	3.886	3.592	3.215	3.016
Northeast	Oak-pine	1.320	1.874	2.314	2.460	2.502	2.423
Northeast	Spruce-balsam fir	1.508	1.617	1.570	1.679	1.642	1.768
Northeast	white-red-jack pine	1.571	2.037	2.388	2.230	1.957	1.868
Northern Lake States	Aspen-birch	1.592	1.402	0.983	1.531	1.861	2.044
Northern Lake States	Elm-ash-cottonwood	0.921	1.098	1.024	1.483	1.661	1.802
Northern Lake States	Maple-beech-birch	1.131	1.240	1.140	1.788	2.239	2.379
Northern Lake States	Oak-hickory	1.466	1.429	1.266	1.752	2.082	2.160
Northern Lake States	Spruce-balsam fir	0.837	1.185	1.138	2.010	2.487	2.805
Northern Lake States	white-red-jack pine	0.146	0.679	1.036	2.260	3.297	3.396
Northern Prarie States	Elm-ash-cottonwood	0.859	0.826	0.669	0.909	1.014	1.359
Northern Prarie States	Maple-beech-birch	1.110	0.942	0.691	0.931	1.067	1.287
Northern Prarie States	Oak-hickory	1.425	1.251	1.016	1.256	1.413	1.476
Northern Prarie States	Oak-pine	1.089	1.063	0.984	1.419	1.801	1.916
Pacific Northwest, East	Douglas-fir	0.607	0.784	0.816	2.198	3.434	3.884
Pacific Northwest, East	Fir-spruce-mountain hemlock	0.691	0.581	0.397	0.868	1.235	1.742
Pacific Northwest, East	Lodgepole pine	0.419	0.628	0.754	1.361	1.884	1.905
Pacific Northwest, East	Ponderosa pine	0.712	0.691	0.586	0.910	1.162	1.177
Pacific Northwest, West	Alder-maple	1.739	2.272	2.638	5.193	7.572	6.932
Pacific Northwest, West	Douglas-fir	1.802	2.214	2.482	5.503	8.379	8.331
Pacific Northwest, West	Fir-spruce-mountain hemlock	0.712	0.890	0.994	2.277	3.456	4.079
Pacific Northwest, West	Hemlock-Sitka spruce	1.299	1.717	1.968	4.182	6.220	6.644

Region	**Species**	**1 through 5**	**6 through 10**	**11 through 15**	**16 through 20**	**21 through 25**	**26 through 30**
Pacific Southwest	Mixed conifer	0.901	0.738	0.502	0.722	0.858	0.962
Pacific Southwest	Fir-spruce-mountain hemlock	0.712	0.675	0.586	0.926	1.172	1.350
Pacific Southwest	Western oak	0.566	0.487	0.377	0.418	0.418	1.429
Rocky Mountain, North	Douglas-fir	0.587	0.544	0.439	1.120	1.749	2.167
Rocky Mountain, North	Fir-spruce-mountain hemlock	0.670	0.549	0.366	0.884	1.329	1.890
Rocky Mountain, North	Lodgepole pine	0.419	0.387	0.303	0.774	1.193	1.518
Rocky Mountain, North	Ponderosa pine	0.712	0.576	0.387	0.774	1.120	1.434
Rocky Mountain, South	Aspen-birch	0.670	0.622	0.471	0.774	0.994	1.261
Rocky Mountain, South	Douglas-fir	0.566	0.565	0.534	1.015	1.434	1.707
Rocky Mountain, South	Fir-spruce-mountain hemlock	0.398	0.366	0.293	0.638	0.942	1.214
Rocky Mountain, South	Lodgepole pine	0.461	0.387	0.283	0.466	0.607	0.774
Rocky Mountain, South	Ponderosa pine	0.377	0.340	0.251	0.481	0.680	0.885
Southeast	Loblolly-shortleaf pine	2.367	2.472	2.303	2.136	2.261	2.135
Southeast	Longleaf-slash pine	1.173	1.644	1.957	2.061	2.281	2.239
Southeast	Oak-gum-cypress	1.487	2.219	2.637	2.532	2.521	2.363
Southeast	Oak-hickory	1.739	2.262	2.430	2.136	2.178	2.041
Southeast	Oak-pine	1.571	2.157	2.440	2.220	2.083	1.968
South Central	Elm-ash-cottonwood	1.823	2.000	2.052	2.031	2.104	2.041
South Central	Loblolly-shortleaf pine	2.284	2.482	2.367	2.147	2.199	2.010
South Central	Oak-gum-cypress	1.152	1.948	2.534	2.419	2.345	2.104
South Central	Oak-hickory	2.053	2.252	2.220	2.073	2.042	1.958
South Central	Oak-pine	1.844	2.304	2.535	2.262	2.157	1.989

Appendix 9.2Aii CCX Carbon Accumulation Tables for Afforestation Offset Projects

☐	Check documentation for legal evidence of entity's ownership of forest land.
☐	Check documentation that forestation activity was done after January 1, 1990.
☐	Check documentation to confirm existence of forests (e.g. Aerial Photograph, Receipt from Seed Purchase, Receipt from Planting)
☐	Determine if records of easement or other evidence of intent to maintain enrolled land as forest are properly documented and signed.
☐	Determine acreage, type of forest land and species included.
☐	Determine that damage caused by pest, fire and weather is properly documented
☐	Determine that any acquisitions or disposals after Jan 1, 2003 are properly documented. (e.g. Date of transfer of ownership.)
☐	Determine if the entity is properly using the CCX approved quantification tables for carbon stocks. (Either using the tables provided in this protocol or direct measurements) a. Planting density b. Age class c. Species Class d. Geographic region
☐	Determine if the net annual changes in carbon stocks in forest stocks are done in accordance to CCX rules (Refer: Rule book. Chapter 9. Section 9.8.2)
☐	Verify that a signed contract with the Offset Aggregator is in the file.

Appendix 9.2Aiii Sample letter of Intent to Maintain Forest Stocks beyond the CCX Market Period for Afforestation Offsets

CHICAGO CLIMATE EXCHANGE
FORESTRY OFFSETS SECTOR

STATEMENT OF INTENT
TO
MAINTAIN FOREST CARBON STOCK
BEYOND 2010

[COMPANY]
[ADDRESS]

TO: CHICAGO CLIMATE EXCHANGE

This Statement of Intent issued by ______________________(“Enrolled Participant”), to Chicago Climate Exchange (“CCX”) confirms Participant’s intent to respect the Principle of Permanence regarding its forest carbon stock to maintain beyond December 31, 2010, excluding catastrophic events and land sales, the quantity of Carbon Stocks held by the Participant in its CCX-registered Afforestation Offset Project as defined in Chapter 9 of the CCX Rulebook including any amendments and/or interpretations thereto.

It is recognized by Participant and CCX that this is a non-binding Statement that reflects the Participant’s intent in regards to the issues described herein. The Participant acknowledges that the effectiveness of forest stocks in sequestering carbon dioxide depend on the forests stocks being maintained for a considerable time period. The Participant acknowledges that an objective of the Chicago Climate Exchange is the development of protocols to advance climate change mitigation objectives and that the Chicago Climate Exchange issues offsets for forest carbon stocks with the objective that the forest stocks sequester carbon for a considerable time period. The Participant acknowledges that they support the objectives of the Chicago Climate Exchange and the use of forest offset projects as a means of carbon sequestration.

DATED this _____ day of _________, [Year]

By:______________________________

Name:____________________________

Title:____________________________

Appendix 9.2B Methods for Quantifying Carbon Accumulation for Urban and Suburban Tree Planting Programs

Step 1: Determine the number and species of qualifying live trees standing at the end of 2002 (or upon Project registration) on lands included in the CCX-registered Project. Qualifying trees are those planted after December 31, 1989 on sites not forested at that time.

Annual carbon sequestration values are calculated **per one hundred trees**.

Step 2: Reference Table 9.3B to determine how many trees in the Project (rounded to the nearest hundred) correspond to the tree types listed below (species: H = Hardwood, C = Conifer) and growth rates (S = Slow, M = Moderate, F = Fast).

Do not include trees with diameters less than 1 inch at breast height.

Step 3: Apply the annual carbon accumulation values provided in Table 9.3C to determine annual metric tons of CO_2.

For the purpose of calculating Tree Age in order to use Table 9.3C, zero-year trees are 1 inch in diameter at Breast Height (total diameter at Breast Height of all trunks for multi-trunk trees).

To calculate Tree Age for trees with a diameter greater than 1 inch, use the following formula:

(Tree diameter (in inches) – 1) multiplied by 3. Round the result to the nearest whole number.

Retain all worksheets, calculations, field assessments and other information on tree counts.

Calculation Example: A city planted 10,000 two-inch diameter White Ash trees in 1996. Those trees were therefore age 3 in 1996, so they are age 10 during 2003. The city concludes that 90% of the trees survived through 2002 (9,000 remain alive).

The carbon sequestration calculation is as follows:

Tree type:	White Ash
Tree count:	9,000
Tree types, growth rate:	H, F
Carbon accumulated during 2003	90 x 2.25 = 202.5 metric tons CO_2 (round up to 203 metric tons).

Appendix Table 9.2B1 Tree Types and Growth Rates Applied to Urban and Suburban Tree Plantings[31]

Species	Type	Growth Rate	Species	Type	Growth Rate
Ailanthus, *Ailanthus altissima*	H	F	Maple, bigleaf, *Acer macrophyllum*	H	S
Alder, European, *Alnus glutinosa*	H	F	Maple, Norway, *Acer platanoides*	H	M
Ash, green, *Fraxinus pennsylvanica*	H	F	Maple, red, *Acer rubrum*	H	M
Ash, mountain, American,*Sorbus americana*	H	M	Maple, silver, *Acer saccharinum*	H	M
Ash, white, *Fraxinus americana*	H	F	Maple, sugar, *Acer saccharum*	H	S
Aspen, bigtooth, *Populus grandidentata*	H	M	Mulberry, red, *Morus rubra*	H	F
Aspen, quaking, *Populus tremuloides*	H	F	Oak, black, *Quercus rubra*	H	M
Baldcypress, *Taxodium distichum*	C	F	Oak, blue, *Quercus douglasii*	H	M
Basswood, American, *Tilia americana*	H	F	Oak, bur, *Quercus macrocarpa*	H	S
Beech, American, *Fagus grandifolia*	H	S	Oak, California black, *Quercus kelloggii*	H	S
Birch, paper (white), *Betula papyrifera*	H	M	Oak, California White, *Quercus lobata*	H	M
Birch, river, *Betula nigra*	H	M	Oak, canyon live, *Quercus chrysolepsis*	H	S
Birch, yellow, *Betula alleghaniensis*	H	S	Oak, chestnut, *Quercus prinus*	H	S
Boxelder, *Acer negundo*	H	F	Oak, Chinkapin, *Quercus muehlenbergii*	H	M
Buckeye, Ohio, *Aesculus glabra*	H	S	Oak, Laurel, *Quercus laurifolia*	H	F
Catalpa, northern, *Catalpa speciosa*	H	F	Oak, live, *Quercus virginiana*	H	F
Cedar-red, eastern, *Juniperus virginiana*	C	M	Oak, northern red, *Quercus rubra*	H	F
Cedar-white, northern, *Thuja occidentalis*	C	M	Oak, overcup, *Quercus lyrata*	H	S
Cherry, black, *Prunus serotina*	H	F	Oak, pin, *Quercus palustris*	H	F
Cherry, pin, *Prunus pennsylvanica*	H	M	Oak, scarlet, *Quercus coccinea*	H	F
Cottonwood, eastern, *Populus deltoides*	H	M	Oak, swamp white, *Quercus bicolor*	H	M
Crabapple, *Malus spp.*	H	M	Oak, water, *Quercus nigra*	H	M
Cucumbertree, *Magnolia acuminata*	H	F	Oak, white, *Quercus alba*	H	S
Dogwood, flowering, *Cornus florida*	H	S	Oak, willow, *Quercus phellos*	H	M
Elm, American, *Ulmus Americana*	H	F	Pecan, *Carya illinoensis*	H	S
Elm, Chinese, *Ulmus parvifolia*	H	M	Pine, European black, *Pinus nigra*	C	S
Elm, rock, *Ulmus thomasii*	H	S	Pine, jack, *Pinus banksiana*	C	F
Elm, September, *Ulmus serotina*	H	F	Pine, loblolly, *Pinus taeda*	C	F
Elm, Siberian, *Ulmus pumila*	H	F	Pine, longleaf, *Pinus palustris*	C	F
Elm, slippery, *Ulmus rubra*	H	M	Pine, ponderosa, *Pinus ponderosa*	C	F
Fir, balsam, *Abies balsamea*	C	S	Pine, red, *Pinus resinosa*	C	F
Fir, Douglas, *Pseudotsuga menziesii*	C	F	Pine, Scotch, *Pinus sylvestris*	C	S
Ginkgo, *Ginkgo biloba*	H	S	Pine, shortleaf, *Pinus echinata*	C	F
Hackberry, *Celtis occidentalis*	H	F	Pine, slash, *Pinus elliottii*	C	F
Hawthorne, *Crataegus spp.*	H	M	Pine, Virginia, *Pinus virginiana*	C	M
Hemlock, eastern, *Tsuga canadensis*	C	M	Pine, white eastern, *Pinus strobus*	C	F

[31] "Method for Calculating Carbon Sequestration by Trees in Urban and Suburban Settings," in Energy Information Administration, U.S. Department of Energy, *Voluntary Reporting of Greenhouse Gases*, April 1998.

Species	Type	Growth Rate	Species	Type	Growth Rate
Hickory, bitternut, *Carya cordiformis*	H	S	Poplar, yellow, *Liriodendron tulipifera*	H	F
Hickory, mockernut, *Carya tomentosa*	H	M	Redbud, eastern, *Cercis canadensis*	H	M
Hickory, shagbark, *Carya ovata*	H	S	Sassafras, *Sassafras albidum*	H	M
Hickory, shellbark, *Carya laciniosa*	H	S	Spruce, black, *Picea mariana*	C	S
Hickory, pignut, *Carya glabra*	H	M	Spruce, blue, *Picea pungens*	C	M
Holly, American, *Ilex opaca*	H	S	Spruce, Norway, *Picea abies*	C	M
Honeylocust, *Gleditsia triacanthos*	H	F	Spruce, red, *Picea rubens*	C	S
Hophornbeam, eastern, *Ostrya virginiana*	H	S	Spruce, white, *Picea glauca*	C	M
Horsechestnut, common, *Aesculus Hippocastanum*	H	F	Sugarberry, *Celtis laevigata*	H	F
Kentucky coffeetree, *Gymnocladus dioicus*	C	F	Sweetgum, *Liquidambar styraciflua*	H	F
Linden, little-leaf, *Tilia cordata*	H	F	Sycamore, *Platanus occidentalis*	H	F
Locust, black, *Robinia pseudoacacia*	H	F	Tamarack, *Larix laricina*	C	F
London plane tree, *Platanus_X_acerifolia*	H	F	Walnut, black, *Juglans nigra*	H	F
Magnolia, southern, *Magnolia grandifolia*	H	M	Willow, black, *Salix nigra*	H	F

Type: H = Hardwood, C = Conifer Growth Rate: S = Slow, M = Moderate, F = Fast

Appendix 9.2B2 Annual CCX Carbon Accumulation Quantities for Urban and Suburban Tree Plantings (Metric tons CO_2) per One Hundred Trees by Tree Type and Age

Annual Sequestration Rates by Tree Type and Growth Rate (metric tons CO_2 per one hundred trees)							
		Hardwood			Conifer		
Tree Age*	Tree diameter (at 4.5 feet height)	Slow	Moderate	Fast	Slow	Moderate	Fast
0	1 inch	0.15	0.22	0.31	0.08	0.12	0.16
1	1.33”	0.19	0.31	0.47	0.10	0.17	0.26
2	1.66”	0.23	0.41	0.63	0.13	0.23	0.36
3	2.0”	0.28	0.50	0.80	0.16	0.29	0.48
4	2.33”	0.33	0.61	0.99	0.19	0.36	0.61
5	2.66”	0.37	0.71	1.18	0.22	0.43	0.75
6	3.0”	0.43	0.83	1.38	0.26	0.51	0.89
7	3.33”	0.48	0.94	1.59	0.29	0.59	1.04
8	3.66”	0.54	1.06	1.81	0.33	0.68	1.19
9	4.0”	0.58	1.19	2.03	0.36	0.77	1.36
10	4.33”	0.64	1.31	2.25	0.41	0.86	1.54
11	4.66”	0.70	1.43	2.48	0.44	0.96	1.71
12	5.0”	0.76	1.57	2.72	0.49	1.06	1.90
13	5.33”	0.82	1.70	2.96	0.54	1.15	2.09
14	5.66”	0.87	1.84	3.21	0.57	1.26	2.28
15	6.0”	0.94	1.97	3.46	0.62	1.38	2.49
16	6.33”	1.00	2.11	3.72	0.66	1.48	2.70
17	6.66”	1.06	2.26	3.97	0.71	1.60	2.91
18	7.0”	1.13	2.40	4.23	0.77	1.71	3.14
19	7.33”	1.19	2.55	4.50	0.82	1.83	3.36
20	7.66”	1.26	2.70	4.78	0.86	1.95	3.59
21	8.0”	1.33	2.84	5.05	0.92	2.07	3.82
22	8.33”	1.40	3.01	5.33	0.97	2.20	4.07
23	8.66”	1.46	3.16	5.61	1.03	2.33	4.31
24	9.0”	1.53	3.31	5.90	1.07	2.46	4.56
25	9.33”	1.60	3.47	6.19	1.13	2.59	4.81
26	9.66”	1.67	3.64	6.48	1.19	2.73	5.07
27	10.0”	1.75	3.79	6.77	1.25	2.87	5.33
28	10.33”	1.82	3.95	7.08	1.31	3.01	5.59
29	10.66”	1.89	4.11	7.38	1.36	3.15	5.86

\

Appendix 9.2Ci CCX Approved Certification Schemes for Sustainable Forest Management[32]

Country	Name	Schemes
Australia	Australian Forestry Standard Limited	Australian Forest Certification Scheme
Austria	PEFC Austria	Austrian Forest Certification Scheme (2006)
Belarus	Belarusian Association of Forest Certification	
Belgium	WoodNet - Commission PEFC Belgique	Belgian Forest Certification Scheme
Brazil	National Institute of Metrology, Standardization and Industrial Quality	Cerflor - Brazilian Program of Forest Certification
Canada	CSA International; SFI, Inc.	CSA Sustainable Forest Management Program SFI – Sustainable Forestry Initiative
Chile	CertforChile Forest Certification Corporation	CertforChile
Czech Republic	PEFC Czech Republic	Czech Forest Certification Scheme (2006)
Denmark	PEFC Denmark	Danish Forest Certification Scheme
Estonia	Estonian Forest Certification Council	Estonian Forest Certification Scheme
Finland	Finnish Forest Certification Council	Finnish Forest Certification Scheme
France	PEFC France	French Forest Certification Scheme (2006)
Gabon	PAFC Gabon	PAFC Gabon Forest Certification Scheme
Germany	PEFC Germany e.V	Revised German Forest Certification Scheme (2005)
Ireland	PEFC Council of Ireland	
Italy	PEFC Italy	Italian Forest Certification Scheme
Latvia	PEFC Latvia Council	Latvian Forest Certification Scheme
Lithuania	PEFC Lietuva (PEFC Lithuania)	Lithuanian Forest Certification Scheme
Luxembourg	PEFC Luxembourg	Luxembourg Certification Scheme for Sustainable Forest Management

[32] http://www.pefc.org/internet/html/members_schemes/4_1120_59.htm

Malaysia	Malaysian Timber Certification Council	
Norway	PEFC-Norway	Norwegian Living Forest Standard and Certification Scheme
Poland	PEFC Polska	Polish Forest Certification Scheme
Portugal	Portuguese Forestry Sector Council	Portuguese Forest Certification Scheme
Russia	Partnership on the Development of PEFC Forest Certification	
Slovakia	Slovak Forest Certification Association	Slovak Forest Certification Scheme
Slovenia	Institute of Forest Certification Slovenia	Slovenian Forest Certification Scheme
Spain	PEFC España	Spanish Forest Certification Scheme
Sweden	Swedish PEFC Co-operative	Swedish Forest Certification Scheme
Switzerland	PEFC Switzerland and HWK-Zertifizierungsstelle	Swiss Q-label certification scheme
United Kingdom	PEFC UK Ltd.	UK Scheme for Sustainable Forest Management
	-	PEFC UK certification scheme for sustainable forest management (revised 2006)
United States	Sustainable Forestry Inc. American Forest Foundation (AFF)	SFI - Sustainable Forestry Initiative American Tree Farm System
International	Forest Stewardship Council (FSC)	Forest Stewardship Council (FSC)

Appendix 9.2Cii . Selected CCX factors for Average Disposition Patterns of Carbon as fractions of Roundwood by Region and Roundwood Category (assuming no bark on roundwood and excluding fuel wood)[33]

Region	Softwood Sawlog	Softwood Pulpwood	Hardwood Sawlog	Hardwood Pulpwood
Northeast	0.318	0.09	0.316	0.261
North Central	0.346	0.092	0.297	0.304
Pacific Northwest (East)	0.337	0.337	0.265	0.265
Pacific Northwest (West)	0.409	0.076	0.477	0.477
Pacific Southwest	0.355	0.355	0.265	0.265
Rocky Mountain	0.367	0.367	0.265	0.265
Southeast	0.336	0.141	0.304	0.188
South Central	0.334	0.162	0.285	0.176

Appendix 9.2Ciii . Volume Multipliers for Converting Timber and Chip Units into Thousand Cubic Feet (MCF)[34]

Unit	Factor
Bone Dry Tons	0.0713
Bone Dry Units	0.0825
Cords	0.075
Cubic Meters	0.0353
Cunits-Chips (CCF)	0.1
Cunits-Roundwood	0.1
Cunits-Whole tree chip	0.126
Green Tons	0.0315
MBF-Doyle	0.222
MBF-International 1/4"	0.146
MBF-Scribner ("C" or "Small")	0.165
MBF-Scribner ("Large" or "Long")	0.145
MCF-Thousand Cubic Feet	1
Oven Dried Tonnes	0.0758

[33] Source: Technical Guidelines for Voluntary Reporting of Greenhouse Gas Program. Part I Appendix Forestry. Table 1.6 Average disposition patterns of carbon as fraction in roundwood by region and roundwood category. Pages 36-48 March 2006
[34] American Forest & Paper Association, Sustainable Forestry Initiative Program Annual Progress Reporting Form.

Appendix 9.2Civ Basic Factors for Converting Merchantable Wood Yield to Carbon Yield by Species[35]

		Specific Gravity	Lbs. per Dry cu. foot	Percent Carbon	Lbs C per Cubic foot
Region	Forest Type				
SE	Loblolly Pine	0.47	29.33	0.531	15.57
SE	Longleaf Pine	0.54	33.70	0.531	17.89
SE	Oak-Hickory (SI = 79)	0.61	38.06	0.479	18.23
NE	Pines	0.41	25.58	0.521	13.33
NE	Spruce-fir	0.37	23.09	0.521	12.03
NE	Oak-hickory (all)	0.61	38.06	0.498	18.96
NE	Maple-beech-birch	0.61	38.06	0.498	18.96
NC	Pines	0.41	25.58	0.521	13.33
NC	Spruce-fir	0.37	23.09	0.521	12.03
NC	Oak-hickory	0.61	38.06	0.498	18.96
NC	Maple-beech	0.58	36.19	0.498	18.02
NC	Aspen-birch	0.46	28.70	0.498	14.29
West	Douglas-fir	0.45	28.08	0.512	14.38
West	Ponderosa pine	0.38	23.71	0.512	12.14
West	Fir-spruce	0.35	21.84	0.512	11.18
West	Hemlock-Sitka sp.	0.43	26.83	0.512	13.74
West	Lodgepole pine	0.42	26.21	0.512	13.42
West	Redwoods	0.42	26.21	0.512	13.42
West	Hardwoods	0.38	23.71	0.496	11.76

[35] Birdsey 1996 (See also Appendices 2 & 3, Sampson and Hair 1996)

Appendix 9.2Di. CCX Forest Project Summary Form

<u>CCX Forest Project Summary Form</u>	
CCX Aggregator	
Project Name	
Geographic Region	
CCX Forest Offset Project Type	
Estimated Annual Metric Tons	
CCX Program Years	
Were Subaggregators Used on Project?	
Project Verifier	
Description of Consulting Services Utilized in Project Proposal Development	

Appendix 9.2Dii. CCX Forest Project Landowner Form

<u>CCX Forest Aggregator Reporting Form</u>	
Landowner Name	
Landowner Acreage	
Forest Age and Species	
Landowner Certification for Sustainable Management	
Legal Description of Land	
Landowner Management Activity	
Most Recent Inventory	
Documentation of Land Acquisition / Disposition	
Evidence of Ownership	
Most Recent Aggregator On-Site Visit	

Appendix 9.3A Exchange Soil Offset Eligible Practices and Offset Issuance Rates by Zone

Zone A:

States and counties included in Zone A are provided in Appendix 9.3B. Exchange Exchange Soil Offsets will be earned at a rate of 0.6 metric tons per acre per year to land managers who commit to continuous conservation tillage for years 2006 through 2010 on acres specified upon project registration. General eligibility criteria and practices for the region include, but are not limited to the following:

(1) Continuous cotton, soybeans and pulse crops (i.e. beans, peas, lintels, etc.) are eligible only if there is a cover crop;
(2) Eligible implements include but are not limited to: no-till drill, no-till and strip-till planters, rolling harrows, low disturbance liquid manure injectors, anhydrous ammonia applicator, manure knife applicator, sub-soil ripper with at least 24 inch shank spacing;
(3) Ineligible implements include but are not limited to: field cultivators, tandem disk, offset disk, chisel plow, moldboard plow;
(4) Histosol soils in Land Resource Region (LRR) T are not eligible;
(5) In general if the implement would require that a leveling or smoothing activity follows, it would likely result in too much soil disturbance
(6) Fallowed acres are not eligible in this region;
(7) No Exchange Soil Offsets will be issued in years in which residue removal and/or burning occurs.

Zone B:

States and counties included in Zone B are provided in Appendix 9.3B. Exchange Soil Offsets will be earned at a rate of 0.4 metric tons per acre per year to land managers who commit to continuous conservation tillage for all of the years 2006 through 2010 on acres specified upon project registration. General eligibility criteria and practices for the region include but are not limited to the following:

(1) For the North Dakota portion of Zone B, adherence to the cropping and implementation guidelines outlined below should at a minimum be reflective of management practices resulting in a Soil Tillage Intensity Rating (STIR) of 20 or less and a Soil Conditioning Index (SCI) or 0.3 or greater (USDA-NRCS North Dakota Conservation Practice Standard 329, September 2005);
(2) Continuous soybeans or pulse crops (i.e. beans, peas, or lintels) are eligible only if there is a cover crop;
(3) Irrigated acreage in Land Resource Region G of Zone B (counties within Land Resource Region G are indicated in Appendix 9.3B) is eligible for enrollment provided that the acreage began irrigation in crop years prior to April 17, 2007. Exchange Soil Offsets will be issued to eligible irrigated acres at a rate of 0.6 metric tons per acre per year;

(4) Eligible implements include but are not limited to: no-till drill, no-till and strip-till planters, rolling harrows, low disturbance liquid manure injectors, anhydrous ammonia applicator, manure knife applicator, sub-soil ripper with at least 24 inch shank spacing;
(5) Ineligible implements include but are not limited to: field cultivators, tandem disk, offset disk, chisel plow, moldboard plow;
(6) In general if the implement would require that a leveling or smoothing activity follow, it would likely result in too much soil disturbance;
(7) Fallowed acres are not eligible in this region;
(8) No Exchange Soil Offsets will be issued in years in which residue removal and/or burning occurs.

Zone C:

States and counties included in Zone C are provided in Appendix 9.3B. Exchange Soil Offsets will be earned at a rate of 0.32 metric tons per acre per year to land managers who commit to continuous conservation tillage for all of the years 2006 through 2010 on acres specified upon project registration. General eligibility criteria and practices for the region include but are not limited to the following:

(1) Continuous soybeans or pulse crops (i.e. beans, peas, or lintels) are eligible only if there is a cover crop;
(2) Irrigated acreage in LRR G of Zone C (counties in LRR G are indicated in Appendix 9.3B) is eligible for enrollment provided that the acreage began irrigation in crop years prior to April 17, 2007. Exchange Soil Offsets will be issued to eligible irrigated acres at a rate of 0.6 metric tons per acre per year;
(3) Eligible implements include but are not limited to: no-till drill, no-till and strip-till planters, rolling harrows, low disturbance liquid manure injectors, anhydrous ammonia applicator, manure knife applicator, sub-soil ripper with at least 24 inch shank spacing;
(4) Ineligible implements include but are not limited to: field cultivators, tandem disk, offset disk, chisel plow, moldboard plow;
(5) In general if the implement would require that a leveling or smoothing activity follow, it would likely result in too much soil disturbance;
(6) Chemical fallowed acres in Major Land Resource Areas (MLRA) 52, 53A, and 54 (county listings provided in Appendix 9.3B) are eligible in this region but will not receive Exchange Soil Offsets for the years in which fallow takes place. Non-fallow years will receive Exchange Soil Offsets at a rate of 0.32 metric tons per acre per year;
(7) No Exchange Soil Offsets will be issued in years in which residue removal and/or burning occurs

Zone D:

States and counties included in Zone D are provided in Appendix 9.3B. Exchange

Soil Offsets will be earned at a rate of 0.2 metric tons per acre per year to land managers who commit to continuous conservation tillage for all of the years 2006 through 2010 on acres specified upon project registration. General eligibility criteria and practices for the region include but are not limited to the following:

(1) Irrigated acreage in LRRs H and G of Zone D (LRR H and LRR G counties indicated in Appendix 9.3B) is eligible for enrollment provided that the acreage began irrigation in crop years prior to April 17, 2007. Exchange Soil Offsets will be issued to eligible irrigated acres at a rate of 0.6 metric tons per acre per year;
(2) Continuous cotton , soybeans or pulse crops (i.e. beans, peas, or lintels) are eligible only if there is a cover crop;
(3) Eligible implements include but are not limited to: no-till drill, no-till and strip-till planters, rolling harrows, low disturbance liquid manure injectors, anhydrous ammonia applicator, manure knife applicator, sub-soil ripper with at least 24 inch shank spacing;
(4) Ineligible implements include but are not limited to: field cultivators, tandem disk, offset disk, chisel plow, moldboard plow;
(5) In general if the implement would require that a leveling or smoothing activity follow, it would likely result in too much soil disturbance;
(6) Fallowed acres are not eligible in this region;
(7) No Exchange Soil Offsets will be issued in years in which residue removal and/or burning occurs.

<u>Zone E:</u>

States and counties included in Zone E are provided in Appendix 9.3B. Exchange Soil Offsets will be earned at a rate of 0.4 metric tons per acre per year to land managers who commit to continuous conservation tillage for all of the years 2006 through 2010 on acres specified upon project registration. General eligibility criteria and practices for the region include but are not limited to the following:

(1) Irrigated acreage in LRR H of Zone E (counties within LRR H are indicated in Appendix 9.3B) is eligible for enrollment provided that the acreage began irrigation in crop years prior to the date of this advisory. Exchange Soil Offsets will be issued to eligible irrigated acres at a rate of 0.6 metric tons per acre per year;
(2) Continuous cotton, soybeans or pulse crops (i.e. beans, peas, or lintels) are eligible only if there is a cover crop;
(3) Histosol soils in Land Resource Region T are not eligible;
(4) Eligible implements include but are not limited to: no-till drill, no-till and strip-till planters, rolling harrows, low disturbance liquid manure injectors, anhydrous ammonia applicator, manure knife applicator, sub-soil ripper with at least 24 inch shank spacing;
(5) Ineligible implements include but are not limited to: field cultivators, tandem disk, offset disk, chisel plow, moldboard plow;
(6) In general if the implement would require that a leveling or smoothing activity follow, it would likely result in too much soil disturbance;

(7) Fallowed acres are not eligible in this region;
(8) No Exchange Soil Offsets will be issued in years in which residue removal and/or burning occurs.

Zone F:

States and counties included in Zone F are provided in Appendix 9.3B. Exchange Soil Offsets will be earned at a rate of 0.2 metric tons per acre per year to land managers who commit to continuous conservation tillage for all of the years 2006 through 2010 on acres specified upon project registration. General eligibility criteria and practices for the region include but are not limited to the following:

(1) Continuous cotton, soybeans or pulse crops (i.e. beans, peas, or lintels) are eligible only if there is a cover crop;
(2) Eligible implements include but are not limited to: no-till drill, no-till and strip-till planters, rolling harrows, low disturbance liquid manure injectors, anhydrous ammonia applicator, manure knife applicator, sub-soil ripper with at least 24 inch shank spacing;
(3) Ineligible implements include but are not limited to: field cultivators, tandem disk, offset disk, chisel plow, moldboard plow;
(4) In general if the implement would require that a leveling or smoothing activity follow, it would likely result in too much soil disturbance;
(5) Fallowed acres are not eligible in this region;
(6) No Exchange Soil Offsets will be issued in years in which residue removal and/or burning occurs.

Zone G:

States and counties included in Zone G are provided in Appendix 9.3B. Exchange Soil Offsets will be earned at a rate of 0.4 metric tons per acre per year to land managers who commit to continuous conservation tillage for all of the years 2006 through 2010 on acres specified upon project registration. General eligibility criteria and practices for the region include but are not limited to the following:

(1) Continuous cotton, soybeans or pulse crops (i.e. beans, peas, or lintels) are eligible only if there is a cover crop;
(2) Eligible implements include but are not limited to: no-till drill, no-till and strip-till planters, rolling harrows, low disturbance liquid manure injectors, anhydrous ammonia applicator, manure knife applicator, sub-soil ripper with at least 24 inch shank spacing;
(3) Ineligible implements include but are not limited to: field cultivators, tandem disk, offset disk, chisel plow, moldboard plow;
(4) In general if the implement would require that a leveling or smoothing activity follow, it would likely result in too much soil disturbance;
(5) Fallowed acres are not eligible in this region;

(6) No Exchange Soil Offsets will be issued in years in which residue removal and/or burning occurs.

Zone H:

Canadian provinces included in Zone H are Manitoba, Saskatchewan and Alberta. Rural municipalities having black and gray soils are eligible to earn Exchange Soil Offsets at a rate of 0.4 metric tons per acre per year to land managers who commit to continuous zero or no-tillage for all of the years 2006 through 2010 on acres specified upon project registration. Rural municipalities having brown and dark brown soils are eligible to earn Exchange Soil Offsets at a rate of 0.2 metric tons per acre per year to land managers who commit to continuous zero or no-tillage for all of the years 2006 through 2010 on acres specified upon project registration. General eligibility criteria and practices for the region include but are not limited to the following:

(1) Seeding must take place via direct seeding into standing stubble using a narrow opener, with not more than 1/3 of the seedbed disturbed. For example, a three inch opener on a nine inch row spacing, or a four inch opener on a 12 inch row spacing;
(2) Chemical fallowed acres in Canada are eligible in this region but will not receive Exchange Soil Offsets for the years in which fallow takes place;
(3) Tillage fallow is not permitted;
(4) Exchange Soil Offsets will not be issued to enrolled acreage in the years in which a flax crop is grown;
(5) Secondary fertilizer application is permitted during crop growth provided it is applied with a narrow opener or via broadcast or surface banding methods;
(6) Deep banding is permitted provided that the implement does not result in heavy soil disturbance including leveling or smoothing the soil after application. For example, a maximum of a 1.5 inch knife on nine inch spacing, or a two inch opener on 12 in spacing is acceptable;
(7) Liquid manure injectors are permitted provided that the implement does not result in heavy soil disturbance including leveling or smoothing the soil after application;
(8) For years in which residue burning and/or removal occurs no credit will be issued on the affected acreage. This includes chaff removal, straw removal/bailing.
(9) Cultivation of any kind is prohibited;
(10) Heavy harrowing including a Phoenix harrow is not permitted.

Appendix 9.3B Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Zone A Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Entire State	Arkansas	Florida
Alabama	Arkansas	Baker
Delaware	Ashley	Bay
Georgia	Bradley	Bradford
Illinois	Calhoun	Calhoun
Indiana	Chicot	Clay
Iowa	Clark	Columbia
Kentucky	Clay	Dixie
Maryland	Cleveland	Duval
Mississippi	Columbia	Escambia
North Carolina	Craighead	Franklin
South Carolina	Crittenden	Gadsden
Tennessee	Cross	Gilchrist
Virginia	Dallas	Gulf
West Virginia	Desha	Hamilton
	Drew	Holmes
	Grant	Jackson
	Greene	Jefferson
	Hempstead	Lafayette
	Howard	Leon
	Jackson	Levy
	Jefferson	Liberty
	Lafayette	Madison
	Lawrence	Nassau
	Lee	Okaloosa
	Lincoln	Santa Rosa
	Little River	Suwannee
	Lonoke	Taylor
	Miller	Union
	Mississippi	Wakulla
	Monroe	Walton
	Nevada	Washington
	Ouachita	
	Phillips	
	Poinsett	
	Prairie	
	Pulaski	
	Sevier	
	St. Francis	
	Union	
	Woodruff	

Zone A Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Kansas	Kansas	Louisiana
Allen	Riley	Ascension
Anderson	Saline	Assumption
Atchison	Sedgwick	Avoyelles
Bourbon	Shawnee	Beauregard
Brown	Wabaunsee	Bienville
Butler	Washington	Bossier
Chase	Wilson	Caddo
Chautauqua	Woodson	Caldwell
Cherokee	Wyandotte	Catahoula
Clay		Claiborne
Cloud		Concordia
Coffey		De Soto
Cowley		East Baton Rouge
Crawford		East Carroll
Dickinson		East Feliciana
Doniphan		Franklin
Douglas		Grant
Elk		Iberia
Ellsworth		Iberville
Franklin		Jackson
Geary		Jefferson
Greenwood		La Salle
Harvey		Lafayette
Jackson		Lincoln
Jefferson		Livingston
Johnson		Madison
Labette		Morehouse
Leavenworth		Natchitoches
Lincoln		Orleans
Linn		Ouachita
Lyon		Pointe Coupee
Marion		Rapides
Marshall		Red River
McPherson		Richland
Miami		Sabine
Montgomery		St. Charles
Morris		St. Helena
Nemaha		St. James
Neosho		St. John the Baptist
Osage		St. Landry
Ottawa		St. Martin
Pottawatomie		St. Mary
Republic		St. Tammany
Rice		Tangipahoa

Zone A Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Louisiana	**Michigan**	**Minnesota**
Tensas	Allegan	Big Stone
Union	Barry	Blue Earth
Vernon	Bay	Brown
Washington	Benzie	Carver
Webster	Berrien	Chippewa
West Baton Rouge	Branch	Cottonwood
West Carroll	Calhoun	Dakota
West Feliciana	Cass	Dodge
Winn	Clinton	Douglas
	Eaton	Faribault
	Genesee	Fillmore
	Gratiot	Freeborn
	Hillsdale	Goodhue
	Huron	Grant
	Ingham	Hennepin
	Ionia	Houston
	Isabella	Jackson
	Jackson	Kandiyohi
	Kalamazoo	Lac qui Parle
	Kent	Le Sueur
	Lapeer	Lincoln
	Lenawee	Lyon
	Livingston	Martin
	Macomb	McLeod
	Manistee	Meeker
	Mason	Mower
	Mecosta	Murray
	Midland	Nicollet
	Monroe	Nobles
	Montcalm	Olmsted
	Muskegon	Pipestone
	Newaygo	Pope
	Oakland	Redwood
	Oceana	Renville
	Ottawa	Rice
	Saginaw	Rock
	Sanilac	Scott
	Shiawassee	Sibley
	St. Clair	Steele
	St. Joseph	Stevens
	Tuscola	Swift
	Van Buren	Wabasha
	Washtenaw	Waseca
	Wayne	Watonwan
		Winona
		Wright
		Yellow Medicine

Zone A Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Missouri	Missouri	Nebraska
Adair	Monroe	Adams
Andrew	Montgomery	Antelope
Atchison	New Madrid	Boone
Audrain	Nodaway	Buffalo
Barton	Osage	Burt
Bates	Pemiscot	Butler
Boone	Perry	Cass
Buchanan	Pettis	Cedar
Butler	Pike	Clay
Caldwell	Platte	Colfax
Callaway	Putnam	Cuming
Cape Girardeau	Ralls	Custer
Carroll	Randolph	Dakota
Cass	Ray	Dawson
Chariton	Saline	Dixon
Clark	Schuyler	Dodge
Clay	Scotland	Douglas
Clinton	Scott	Fillmore
Cole	Shelby	Gage
Cooper	St. Charles	Greeley
Daviess	St. Louis	Hall
DeKalb	Stoddard	Hamilton
Dunklin	Sullivan	Howard
Gasconade	Vernon	Jefferson
Gentry	Warren	Johnson
Grundy	Worth	Kearney
Harrison		Lancaster
Henry		Madison
Holt		Merrick
Howard		Nance
Jackson		Nemaha
Jasper		Nuckolls
Johnson		Otoe
Knox		Pawnee
Lafayette		Phelps
Lewis		Pierce
Lincoln		Platte
Linn		Polk
Livingston		Richardson
Macon		Saline
Marion		Sarpy
Mercer		Saunders
Mississippi		Seward
Moniteau		Sherman

Zone A Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Nebraska	New Jersey	Ohio
Stanton	Atlantic	Adams
Thayer	Burlington	Allen
Thurston	Camden	Ashland
Valley	Cape May	Athens
Washington	Cumberland	Auglaize
Wayne	Gloucester	Belmont
York	Hunterdon	Brown
	Mercer	Butler
	Middlesex	Carroll
	Monmouth	Champaign
	Morris	Clark
	Ocean	Clermont
	Salem	Clinton
	Somerset	Coshocton
		Crawford
		Darke
		Defiance
		Delaware
		Erie
		Fairfield
		Fayette
		Franklin
		Fulton
		Gallia
		Greene
		Guernsey
		Hamilton
		Hancock
		Hardin
		Harrison
		Henry
		Highland
		Hocking
		Holmes
		Huron
		Jackson
		Jefferson
		Knox
		Lawrence
		Licking
		Logan
		Lucas
		Madison
		Marion

Zone A Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Ohio	Oklahoma	Pennsylvania
Meigs	Bryan	Adams
Mercer	Choctaw	Allegheny
Miami	Craig	Armstrong
Monroe	Mayes	Beaver
Montgomery	Muskogee	Bedford
Morgan	Nowata	Berks
Morrow	Okfuskee	Blair
Muskingum	Okmulgee	Bucks
Noble	Osage	Butler
Ottawa	Ottawa	Cambria
Paulding	Rogers	Cameron
Perry	Tulsa	Carbon
Pickaway	Wagoner	Centre
Pike	Washington	Chester
Preble		Clarion
Putnam		Clearfield
Richland		Clinton
Ross		Columbia
Sandusky		Cumberland
Scioto		Dauphin
Seneca		Delaware
Shelby		Elk
Tuscarawas		Fayette
Union		Forest
Van Wert		Franklin
Vinton		Fulton
Warren		Greene
Washington		Huntingdon
Williams		Indiana
Wood		Jefferson
Wyandot		Juniata
		Lancaster
		Lebanon
		Lehigh
		Lycoming
		McKean
		Mifflin
		Montgomery
		Montour
		Northampton
		Northumberland
		Perry
		Philadelphia
		Potter

Zone A Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Pennsylvania	South Dakota	Texas
Schuylkill	Bon Homme	Anderson
Snyder	Brookings	Angelina
Somerset	Clark	Bowie
Union	Clay	Camp
Venango	Codington	Cass
Warren	Day	Cherokee
Washington	Deuel	Franklin
Westmoreland	Grant	Gregg
York	Hamlin	Harrison
	Hanson	Henderson
	Hutchinson	Houston
	Kingsbury	Jasper
	Lake	Marion
	Lincoln	Montgomery
	Marshall	Morris
	McCook	Nacogdoches
	Minnehaha	Newton
	Moody	Panola
	Roberts	Polk
	Turner	Rains
	Union	Red River
	Yankton	Rusk
		Sabine
		San Augustine
		San Jacinto
		Shelby
		Smith
		Titus
		Trinity
		Tyler
		Upshur
		Van Zandt
		Walker
		Wood

Zone A Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Wisconsin
Buffalo
Crawford
Grant
Iowa
La Crosse
Lafayette
Monroe
Pepin
Richland
Sauk
Trempealeau
Vernon

Zone B Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Michigan	Minnesota	Nebraska
Alcona	Aitkin	Arthur [2]
Alger	Anoka	Banner [2]
Alpena	Becker	Blaine [2]
Antrim	Beltrami	Box Butte [2]
Arenac	Benton	Boyd [2]
Baraga	Carlton	Brown [2]
Charlevoix	Cass	Cherry [2]
Cheboygan	Chisago	Dawes [2]
Chippewa	Clay	Garden [2]
Clare	Clearwater	Garfield [2]
Crawford	Cook	Grant [2]
Delta	Crow Wing	Holt [2]
Dickinson	Hubbard	Hooker [2]
Emmet	Isanti	Keya Paha [2]
Gladwin	Itasca	Kimball [2]
Gogebic	Kanabec	Knox [2]
Grand Traverse	Kittson	Logan [2]
Houghton	Koochiching	Loup [2]
Iosco	Lake	McPherson [2]
Iron	Lake of the Woods	Morrill [2]
Kalkaska	Mahnomen	Rock [2]
Keweenaw	Marshall	Scotts Bluff [2]
Lake	Mille Lacs	Sheridan [2]
Luce	Morrison	Sioux [2]
Mackinac	Norman	Thomas [2]
Marquette	Otter Tail	Wheeler [2]
Menominee	Pennington	
Missaukee	Pine	
Montmorency	Polk	
Ogemaw	Ramsey	
Ontonagon	Red Lake	
Osceola	Roseau	
Oscoda	Sherburne	
Otsego	St. Louis	
Presque Isle	Stearns	
Roscommon	Todd	
Schoolcraft	Traverse	
Wexford	Wadena	
	Washington	
	Wilkin	

[2] County is within LRR G or H
[3] County is within MRLA 52, 53A or 54

Zone B Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

North Dakota	North Dakota	South Dakota
Adams[3]	Stark[3]	Aurora
Barnes	Steele	Beadle
Benson	Stutsman	Bennett [2]
Billings [2]	Towner	Brown
Bottineau	Traill	Brule
Bowman [2]	Walsh	Buffalo
Burke	Ward	Butte [2]
Burleigh	Wells	Campbell
Cass	Williams[3]	Charles Mix
Cavalier		Corson[3]
Dickey		Custer [2]
Divide[3]		Davison
Dunn[3]		Dewey [2]
Eddy		Douglas
Emmons		Edmunds
Foster		Fall River [2]
Golden Valley		Faulk
Grand Forks		Gregory [2]
Grant[3]		Haakon [2]
Griggs		Hand
Hettinger[3]		Harding [2]
Kidder		Hughes
LaMoure		Hyde
Logan		Jackson [2]
McHenry		Jerauld
McIntosh		Jones [2]
McKenzie		Lawrence [2]
McLean		Lyman [2]
Mercer[3]		McPherson
Morton[3]		Meade [2]
Mountrail		Mellette [2]
Nelson		Miner
Oliver[3]		Pennington [2]
Pembina		Perkins[3]
Pierce		Potter
Ramsey		Sanborn
Ransom		Shannon [2]
Renville		Spink
Richland		Stanley [2]
Rolette		Sully
Sargent		Todd [2]
Sheridan		Tripp [2]
Sioux[3]		Walworth
Slope[2]		Ziebach[3]

[2] County is within LRR G or H
[3] County is within MRLA 52, 53A or 54

Zone B Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Wisconsin	Wisconsin
Adams	Marathon
Ashland	Marinette
Barron	Marquette
Bayfield	Menominee
Brown	Milwaukee
Burnett	Oconto
Calumet	Oneida
Chippewa	Outagamie
Clark	Ozaukee
Columbia	Pierce
Dane	Polk
Dodge	Portage
Door	Price
Douglas	Racine
Dunn	Rock
Eau Claire	Rusk
Florence	Sawyer
Fond du Lac	Shawano
Forest	Sheboygan
Green	St. Croix
Green Lake	Taylor
Iron	Vilas
Jackson	Walworth
Jefferson	Washburn
Juneau	Washington
Kenosha	Waukesha
Kewaunee	Waupaca
Langlade	Waushara
Lincoln	Winnebago
Manitowoc	Wood

Zone C Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Montana	Wyoming
Big Horn [2]	Campbell [2]
Blaine[3]	Converse [2]
Carter [2]	Crook [2]
Cascade[3]	Goshen [2]
Chouteau[3]	Johnson [2]
Custer [2]	Laramie [2]
Daniels[3]	Niobrara [2]
Dawson [2]	Platte [2]
Fallon [2]	Sheridan [2]
Fergus [2]	Weston [2]
Garfield [2]	
Glacier[3]	
Golden Valley [2]	
Hill[3]	
Liberty[3]	
McCone[3]	
Musselshell [2]	
Petroleum [2]	
Phillips[3]	
Pondera[3]	
Powder River [2]	
Prairie [2]	
Richland[3]	
Roosevelt[3]	
Rosebud [2]	
Sheridan[3]	
Teton[3]	
Toole[3]	
Treasure [2]	
Valley[3]	
Wheatland [2]	
Wibaux[3]	
Yellowstone [2]	

[2] County is within LRR G or H
[3] County is within MRLA 52, 53A or 54

Zone D Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Colorado	Kansas	Nebraska
Adams [2]	Cheyenne [2]	Chase [2]
Arapahoe [2]	Clark [2]	Cheyenne [2]
Baca [2]	Comanche [2]	Deuel [2]
Bent [2]	Finney [2]	Dundy [2]
Cheyenne [2]	Gove [2]	Hitchcock [2]
Crowley [2]	Grant [2]	Keith [2]
Denver [2]	Greeley [2]	Lincoln [2]
Elbert [2]	Hamilton [2]	Perkins [2]
Kiowa [2]	Haskell [2]	
Kit Carson [2]	Kearny [2]	
Las Animas [2]	Lane [2]	
Lincoln [2]	Logan [2]	
Logan [2]	Meade [2]	
Morgan [2]	Morton [2]	
Otero [2]	Rawlins [2]	
Phillips [2]	Scott [2]	
Prowers [2]	Seward [2]	
Pueblo [2]	Sheridan [2]	
Sedgwick [2]	Sherman [2]	
Washington [2]	Stanton [2]	
Weld [2]	Stevens [2]	
Yuma [2]	Thomas [2]	
	Wallace [2]	
	Wichita [2]	

[2] County is within LRR G or H

Zone D Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

New Mexico	Oklahoma	Texas
Chaves [2]	Beaver [2]	Andrews [2]
Colfax [2]	Beckham [2]	Archer [2]
Curry [2]	Caddo [2]	Armstrong [2]
De Baca [2]	Cimarron [2]	Atascosa
Eddy [2]	Comanche [2]	Bailey [2]
Guadalupe [2]	Cotton [2]	Bandera
Harding [2]	Custer [2]	Baylor [2]
Lea [2]	Dewey [2]	Bee
Lincoln [2]	Ellis [2]	Bexar
Mora [2]	Greer [2]	Blanco
Quay [2]	Harmon [2]	Borden [2]
Roosevelt [2]	Harper [2]	Briscoe [2]
San Miguel [2]	Jackson [2]	Brooks
Santa Fe [2]	Jefferson [2]	Brown [2]
Torrance [2]	Kiowa [2]	Callahan [2]
Union [2]	Roger Mills [2]	Cameron
	Stephens [2]	Carson [2]
	Texas [2]	Castro [2]
	Tillman [2]	Childress [2]
	Washita [2]	Clay [2]
	Woods [2]	Cochran [2]
	Woodward [2]	Coke [2]
		Coleman [2]
		Collingsworth [2]
		Comal
		Concho [2]
		Cottle [2]
		Crockett
		Crosby [2]
		Dallam [2]
		Dawson [2]
		Deaf Smith [2]
		DeWitt
		Dickens [2]
		Dimmit
		Donley [2]
		Duval
		Ector [2]
		Edwards
		Fisher [2]
		Floyd [2]
		Foard [2]
		Frio
		Gaines [2]
		Garza [2]

[2] County is within LRR G or H

Zone D Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Texas	Texas
Gillespie	Mitchell [2]
Glasscock	Montague [2]
Goliad	Moore [2]
Gray [2]	Motley [2]
Hale [2]	Nolan [2]
Hall [2]	Ochiltree [2]
Hansford [2]	Oldham [2]
Hardeman [2]	Palo Pinto [2]
Hartley [2]	Parmer [2]
Haskell [2]	Potter [2]
Hays	Randall [2]
Hemphill [2]	Reagan
Hidalgo	Real
Hockley [2]	Roberts [2]
Howard [2]	Runnels [2]
Hutchinson [2]	San Saba
Irion	Schleicher
Jack [2]	Scurry [2]
Jim Hogg	Shackelford [2]
Jim Wells	Sherman [2]
Jones [2]	Starr
Karnes	Stephens [2]
Kendall	Sterling
Kenedy	Stonewall [2]
Kent [2]	Sutton
Kerr	Swisher [2]
Kimble	Taylor [2]
King [2]	Terrell
Kinney	Terry [2]
Kleberg	Throckmorton [2]
Knox [2]	Tom Green [2]
La Salle	Travis
Lamb [2]	Upton
Lipscomb [2]	Uvalde
Live Oak	Val Verde
Llano	Webb
Lubbock [2]	Wheeler [2]
Lynn [2]	Wichita [2]
Martin [2]	Wilbarger [2]
Mason	Willacy
Maverick	Williamson
McCulloch	Wilson
McMullen	Yoakum [2]
Medina	Young [2]
Menard	Zapata
Midland [2]	Zavala

[2] County is within LRR G or H

Zone E Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Kansas	Louisiana	Nebraska
Barber [2]	Acadia	Franklin [2]
Barton [2]	Allen	Frontier [2]
Decatur [2]	Calcasieu	Furnas [2]
Edwards [2]	Cameron	Gosper [2]
Ellis [2]	Evangeline	Harlan [2]
Ford [2]	Jefferson Davis	Hayes [2]
Graham [2]	Lafourche	Red Willow [2]
Gray [2]	Plaquemines	Webster [2]
Harper [2]	St. Bernard	
Hodgeman [2]	Terrebonne	
Jewell [2]	Vermilion	
Kingman [2]		
Kiowa [2]		
Mitchell [2]		
Ness [2]		
Norton [2]		
Osborne [2]		
Pawnee [2]		
Phillips [2]		
Pratt [2]		
Reno [2]		
Rooks [2]		
Rush [2]		
Russell [2]		
Smith [2]		
Stafford [2]		
Sumner [2]		
Trego [2]		

[2] County is within LRR G or H

Zone E Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Oklahoma	Texas	Texas
Alfalfa [2]	Aransas	Hill
Blaine [2]	Austin	Hood
Canadian [2]	Bastrop	Hopkins
Carter	Bell	Hunt
Cleveland [2]	Bosque	Jackson
Coal	Brazoria	Jefferson
Creek	Brazos	Johnson
Garfield [2]	Burleson	Kaufman
Garvin	Burnet	Lamar
Grady	Caldwell	Lampasas
Grant [2]	Calhoun	Lavaca
Johnston	Chambers	Lee
Kay [2]	Collin	Leon
Kingfisher [2]	Colorado	Liberty
Lincoln	Comanche	Limestone
Logan [2]	Cooke	Madison
Love	Coryell	Matagorda
Major [2]	Dallas	McLennan
Marshall	Delta	Milam
McClain [2]	Denton	Mills
Murray	Eastland	Navarro
Noble [2]	Ellis	Nueces
Oklahoma [2]	Erath	Orange
Pawnee [2]	Falls	Parker
Payne [2]	Fannin	Refugio
Pontotoc	Fayette	Robertson
Pottawatomie	Fort Bend	Rockwall
Seminole	Freestone	San Patricio
	Galveston	Somervell
	Gonzales	Tarrant
	Grayson	Victoria
	Grimes	Waller
	Guadalupe	Washington
	Hamilton	Wharton
	Hardin	Wise
	Harris	

[2] County is within LRR G or H

Zone F Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

Arkansas	Missouri	Oklahoma
Baxter	Barry	Adair
Benton	Benton	Atoka
Boone	Bollinger	Cherokee
Carroll	Camden	Delaware
Cleburne	Carter	Haskell
Conway	Cedar	Hughes
Crawford	Christian	Latimer
Faulkner	Crawford	Le Flore
Franklin	Dade	McCurtain
Fulton	Dallas	McIntosh
Garland	Dent	Pittsburg
Hot Spring	Douglas	Pushmataha
Independence	Franklin	Sequoyah
Izard	Greene	
Johnson	Hickory	
Logan	Howell	
Madison	Iron	
Marion	Jefferson	
Montgomery	Laclede	
Newton	Lawrence	
Perry	Madison	
Pike	Maries	
Polk	McDonald	
Pope	Miller	
Randolph	Morgan	
Saline	Newton	
Scott	Oregon	
Searcy	Ozark	
Sebastian	Phelps	
Sharp	Polk	
Stone	Pulaski	
Van Buren	Reynolds	
Washington	Ripley	
White	Shannon	
Yell	St. Clair	
	St. Francois	
	Ste. Genevieve	
	Stone	
	Taney	
	Texas	
	Washington	
	Wayne	
	Webster	
	Wright	

Zone G Counties that Qualify for Exchange Soil Offsets for Conservation Tillage

New York
Cayuga
Erie
Genesee
Livingston
Madison
Monroe
Montgomery
Niagara
Oneida
Onondaga
Ontario
Orleans
Oswego
Schenectady
Seneca
Wayne
Yates

Appendix 9.3C Exchange Soil Offset Permanent Grassland Planting Practices and Offset Issuance Rates by Zone

<u>Grassland Zone A:</u>

States and counties included in Zone A are provided in this Appendix. Canadian provinces of Manitoba, Saskatchewan, Alberta and British Columbia are included in Zone A.[36] Exchange Soil Offsets will be earned at a rate of 1.0 metric tons per acre per year to land managers who commit to maintain increases in soil carbon stocks realized as a result of grass cover plantings that were undertaken on or after January 1, 1999. Such grass cover must be maintained through 2010 on the acres specified upon project registration.

<u>Grassland Zone B:</u>

States and counties included in Zone B are provided in this Appendix. Exchange Soil Offsets will be earned at a rate of 0.4 metric tons per acre per year to land managers who commit to maintain increases in soil carbon stocks realized as a result of permanent (i.e. not harvested) grass cover plantings that were undertaken on or after January 1, 1999. Such grass cover must be maintained through 2010 on the acres specified upon project registration.

[36] For eligible regions within Canada, please contact CCX Staff.

Appendix 9.3C Counties that Qualify for Exchange Soil Offsets for Grassland Planting

Zone A Counties that Qualify for Exchange Soil Offsets for Grassland Planting

Entire State	Colorado	Colorado
Alabama	Adams	Logan
Arkansas	Alamosa	Mineral
Connecticut	Arapahoe	Morgan
Delaware	Archuleta	Otero
Florida	Baca	Ouray
Georgia	Bent	Park
Illinois	Boulder	Phillips
Indiana	Broomfield	Pitkin
Iowa	Chaffee	Prowers
Kansas	Cheyenne	Pueblo
Kentucky	Clear Creek	Rio Grande
Louisiana	Conejos	Routt
Maine	Costilla	Saguache
Maryland	Crowley	San Juan
Massachusetts	Custer	Sedgwick
Michigan	Denver	Summit
Minnesota	Douglas	Teller
Missouri	Eagle	Washington
Montana	El Paso	Weld
Nebraska	Elbert	Yuma
New Hampshire	Fremont	
New Jersey	Garfield	
New York	Gilpin	
North Carolina	Grand	
North Dakota	Gunnison	
Ohio	Hinsdale	
Pennsylvania	Huerfano	
Rhode Island	Jackson	
South Carolina	Jefferson	
South Dakota	Kiowa	
Tennessee	Kit Carson	
Vermont	Lake	
Virginia	Larimer	
West Virginia	Las Animas	
Wisconsin	Lincoln	

Zone A Counties that Qualify for Exchange Soil Offsets for Grassland Planting

Idaho	New Mexico	Oklahoma
Adams	Colfax	Adair
Benewah	Rio Arriba	Alfalfa
Boise	Taos	Atoka
Bonner		Beaver
Boundary		Bryan
Clearwater		Canadian
Custer		Carter
Idaho		Cherokee
Kootenai		Choctaw
Shoshone		Cimarron
Valley		Cleveland
		Coal
		Craig
		Creek
		Delaware
		Garfield
		Garvin
		Grady
		Grant
		Harper
		Haskell
		Hughes
		Jefferson
		Johnston
		Kay
		Kingfisher
		Latimer
		Le Flore
		Lincoln
		Logan
		Love

Zone A Counties that Qualify for Exchange Soil Offsets for Grassland Planting

Oklahoma	Oregon	Texas
Major	Benton	Anderson
Marshall	Clackamas	Angelina
Mayes	Clatsop	Aransas
McClain	Columbia	Austin
McCurtain	Coos	Bastrop
McIntosh	Curry	Bell
Murray	Douglas	Bosque
Muskogee	Grant	Bowie
Noble	Hood River	Brazoria
Nowata	Jackson	Brazos
Okfuskee	Josephine	Burleson
Oklahoma	Lane	Burnet
Okmulgee	Lincoln	Caldwell
Osage	Linn	Calhoun
Ottawa	Marion	Camp
Pawnee	Multnomah	Cass
Payne	Polk	Chambers
Pittsburg	Tillamook	Cherokee
Pontotoc	Union	Collin
Pottawatomie	Wallowa	Colorado
Pushmataha	Washington	Comanche
Rogers	Yamhill	Cooke
Seminole		Coryell
Sequoyah		Dallas
Stephens		Delta
Texas		Denton
Tulsa		Eastland
Wagoner		Ellis
Washington		Erath
Woods		Falls
Woodward		Fannin
		Fayette
		Fort Bend
		Franklin
		Freestone
		Galveston
		Gonzales
		Grayson
		Gregg
		Grimes

Zone A Counties that Qualify for Exchange Soil Offsets for Grassland Planting

Texas	**Texas**	**Utah**
Guadalupe	Newton	Cache
Hamilton	Nueces	Carbon
Hardin	Orange	Daggett
Harris	Panola	Duchesne
Harrison	Parker	Morgan
Henderson	Polk	Rich
Hill	Rains	Summit
Hood	Red River	Utah
Hopkins	Refugio	Wasatch
Houston	Robertson	
Hunt	Rockwall	
Jackson	Rusk	
Jasper	Sabine	
Jefferson	San Augustine	
Johnson	San Jacinto	
Kaufman	San Patricio	
Lamar	Shelby	
Lampasas	Smith	
Lavaca	Somervell	
Lee	Tarrant	
Leon	Titus	
Liberty	Trinity	
Limestone	Tyler	
Madison	Upshur	
Marion	Van Zandt	
Matagorda	Victoria	
McLennan	Walker	
Milam	Waller	
Mills	Washington	
Montgomery	Wharton	
Morris	Wise	
Nacogdoches	Wood	
Navarro		

Zone A Counties that Qualify for Exchange Soil Offsets for Grassland Planting

Washington	Wyoming
Clallam	Big Horn
Clark	Campbell
Cowlitz	Converse
Ferry	Crook
Grays Harbor	Goshen
Island	Hot Springs
Jefferson	Johnson
King	Laramie
Kitsap	Lincoln
Lewis	Niobrara
Mason	Park
Pacific	Platte
Pend Oreille	Sheridan
Pierce	Sublette
San Juan	Teton
Skagit	Uinta
Skamania	Weston
Snohomish	
Stevens	
Thurston	
Wahkiakum	
Whatcom	

Zone B Counties that Qualify for Exchange Soil Offsets for Grassland Planting

Entire State	Colorado	Idaho
Arizona	Delta	Ada
California	Dolores	Bannock
Nevada	La Plata	Bear Lake
	Mesa	Bingham
	Moffat	Blaine
	Montezuma	Bonneville
	Montrose	Butte
	Rio Blanco	Camas
	San Miguel	Canyon
		Caribou
		Cassia
		Clark
		Elmore
		Franklin
		Fremont
		Gem
		Gooding
		Jefferson
		Jerome
		Latah
		Lemhi
		Lewis
		Lincoln
		Madison
		Minidoka
		Nez Perce
		Oneida
		Owyhee
		Payette
		Power
		Teton
		Twin Falls
		Washington

Zone B Counties that Qualify for Exchange Soil Offsets for Grassland Planting

New Mexico	Oklahoma	Oregon
Bernalillo	Beckham	Baker
Catron	Blaine	Crook
Chaves	Caddo	Deschutes
Cibola	Comanche	Gilliam
Curry	Cotton	Harney
De Baca	Custer	Jefferson
Dona Ana	Dewey	Klamath
Eddy	Ellis	Lake
Grant	Greer	Malheur
Guadalupe	Harmon	Morrow
Harding	Jackson	Sherman
Hidalgo	Kiowa	Umatilla
Lea	Rogers Mills	Wasco
Lincoln	Tillman	Wheeler
Los Alamos	Washita	
Luna		
McKinley		
Mora		
Otero		
Quay		
Roosevelt		
San Juan		
San Miguel		
Sandoval		
Santa Fe		
Sierra		
Socorro		
Torrance		
Union		
Valencia		

Zone B Counties that Qualify for Exchange Soil Offsets for Grassland Planting

Texas	Texas	Texas
Andrews	Dallam	Hudspeth
Archer	Dawson	Hutchinson
Armstrong	Deaf Smith	Irion
Atascosa	DeWitt	Jack
Bailey	Dickens	Jeff Davis
Bandera	Dimmit	Jim Hogg
Baylor	Donley	Jim Wells
Bee	Duval	Jones
Bexar	Ector	Karnes
Blanco	Edwards	Kendall
Borden	El Paso	Kenedy
Brewster	Fisher	Kent
Briscoe	Floyd	Kerr
Brooks	Foard	Kimble
Brown	Frio	King
Callahan	Gaines	Kinney
Cameron	Garza	Kleberg
Carson	Gillespie	Knox
Castro	Glasscock	La Salle
Childress	Goliad	Lamb
Clay	Gray	Lipscomb
Cochran	Hale	Live Oak
Coke	Hall	Llano
Coleman	Hansford	Loving
Collingsworth	Hardeman	Lubbock
Comal	Hartley	Lynn
Concho	Haskell	Martin
Cottle	Hays	Mason
Crane	Hemphill	Maverick
Crockett	Hidalgo	McCulloch
Crosby	Hockley	McMullen
Culberson	Howard	Medina

Zone B Counties that Qualify for Exchange Soil Offsets for Grassland Planting

Texas	Texas	Utah
Menard	Sterling	Beaver
Midland	Stonewall	Box Elder
Mitchell	Sutton	Davis
Montague	Swisher	Emery
Moore	Taylor	Garfield
Motley	Terrell	Grand
Nolan	Terry	Iron
Ochiltree	Throckmorton	Juab
Oldham	Tom Green	Kane
Palo Pinto	Travis	Millard
Parmer	Upton	Piute
Pecos	Uvalde	Salt Lake
Potter	Val Verde	San Juan
Presidio	Ward	Sanpete
Randall	Webb	Sevier
Reagan	Wheeler	Tooele
Real	Wichita	Uintah
Reeves	Wilbarger	Washington
Roberts	Willacy	Wayne
Runnels	Williamson	Weber
San Saba	Wilson	
Schleicher	Winkler	
Scurry	Yoakum	
Shackelford	Young	
Sherman	Zapata	
Starr	Zavala	
Stephens		

Zone B Counties that Qualify for Exchange Soil Offsets for Grassland Planting

Washington	**Wyoming**
Adams	Albany
Asotin	Carbon
Benton	Fremont
Chelan	Natrona
Columbia	Sweetwater
Douglas	Washakie
Franklin	
Garfield	
Grant	
Kittitas	
Klickitat	
Lincoln	
Okanogan	
Spokane	
Walla Walla	
Whitman	
Yakima	

Appendix 9.3D Protocol for Verifying CCX Rangeland Soil Carbon Management Offset Projects and Eligible Counties

This appendix summarizes the eligibility and verification requirements for CCX Rangeland Soil Carbon Management Offset Projects eligible for registration in Chicago Climate Exchange.

Topics covered in this Appendix include:

- Overview of eligibility requirements and overall approach for generating Offsets from managed rangeland;
- Overview of a Protocol for verifying conforming projects;
- List of indicators for carbon-related management practices for rangeland.

Project Eligibility Requirements

Certain rangelands managed to enhance carbon storage in the soil are eligible for inclusion in the CCX Rangeland Soil Carbon Management Offsets program provided each of the following conditions are met (1-4):

1. The project takes place on rangeland, which is defined by the NRCS as:

"Land on which the historic plant community is principally native grasses, grasslike plants, forbs or shrubs suitable for grazing and browsing. In most cases, range supports native vegetation that is extensively managed through the control of livestock rather than by agronomy practices, such as fertilization, mowing, or irrigation. Rangeland also includes areas that have been seeded to introduced species (e.g., clover or crested wheatgrass) but are managed with the same methods as native range[37] ."

2. The project is in a geographic area for which data on soil sequestration rates for rangeland are available to CCX. A List of eligible counties defines these areas.

3. Project involves rangeland management practices that include use of ***all*** of the following tools through the adoption of a formal grazing plan:
   a. Light or Moderate Stocking rates;
   b. Sustainable Livestock Distribution which includes:
      i. Rotational grazing
      ii. Seasonal use.

The Natural Resources Conservation Service (NRCS) Field Office Technical Guides publish guidelines for managing the controlled harvest of vegetation with grazing animals. Stocking rates and livestock distribution criteria are defined according to County and State in the NRCS "Prescribed Grazing Specification" code. A formal grazing plan may be developed with the input of NRCS, BLM, USFS other non-profit agencies or private rangeland consulting firms. Regardless of the source of the grazing plan, it must at a minimum adhere to NRCS standards. A rancher that does not have a formal grazing plan may enroll in CCX with the agreement that he/she will complete a formal grazing plan prior to the next grazing season.

---

[37] In many cases, Rangeland refers to areas in the Western part of the U.S., while the general term "Grazing Lands" is used in regions East of the Mississippi. The use of the term Rangeland in this protocol is a land use designation and not a geographic designation. Land that fits the above definition of Rangeland *may* be eligible for CCX Rangeland Soil Offsets whether it is nominally referred to as Rangeland or Grazing Land provided that appropriate crediting rates can be established.

In most regions Rangeland that can be classified as degraded prior to inception of the project is eligible for different crediting rates. Degraded rangeland indicators specific to soil carbon storage are listed below and include soil surface loss or degradation and heavy stocking rates (exceeding carrying capacity of project land).

4. The project owner can demonstrate that its rangeland holdings outside of the Project are sustainably managed.

Documentation of Rangeland Management Practices

Conformance with the above eligibility requirements may be documented using the following methods (to be confirmed via site visit by CCX-approved verifier):

- Photographs of project site (e.g. aerial, remote sensing)
- Ranch records of stocking rates and grazing rotation patterns
- Records from agricultural extension agents or other agencies performing a monitoring function.

NRCS indicators of degraded rangeland related to below-ground carbon storage

The U.S. Natural Resources Conservation Service (NRCS) has established indicators of degraded rangeland that are published in "*Interpreting Indicators of Rangeland Health*" (U.S. Natural Resources Conservation Service, 2005). Eligibility to earn CCX Rangeland Soil Carbon Management Offsets based on restoration of degraded rangeland requires that the included rangelands must fall under the NRCS designation "Extreme" or "Moderate to Extreme" for indicators 1 and 2, and "Slight to Moderate, Moderate, Moderate to Extreme or Extreme" for indicator 3 to qualify as degraded. The applicable indicators are summarized below. A project site may qualify as degraded if any of the following indicators are present.

Indicator: Bare Ground

Indicator	Degree of Departure from Ecological Site Description and/or Ecological Reference Area(s)	
	Extreme	Moderate to Extreme
Bare Ground	Much higher than expected for the site. Bare areas are large and generally connected.	Moderate to much higher than expected for the site. Bare areas are large and occasionally connected.

Indicator: Soil Surface Loss or Degradation

Indicator	Degree of Departure from Ecological Site Description and/or Ecological Reference Area(s)	
	Extreme	Moderate to Extreme
Soil Surface Loss or Degradation	Soil surface horizon absent. Soil structure near surface is similar to, or more degraded, than that in subsurface horizons. No distinguishable difference in subsurface organic matter content.	Soil loss or degradation severe throughout site. Minimal differences in soil organic matter content and structure and subsurface layers.

Indicator: Annual Production

Indicator	Degree of Departure from Ecological Site Description and/or Ecological Reference Area(s)			
	Extreme	Moderate to Extreme	Moderate	Slight to Moderate
Annual Production	Less than 20% of potential production for the site based on recent weather.	20-40% of potential production for the site based on recent weather.	40-60% of potential production for the site based on recent weather.	60-80% of potential production for the site based on recent weather.

Protocol for Drought Stricken Rangeland Soil Offset Projects

It is generally agreed that severe or multi-year (ongoing) drought would cause loss of soil organic carbon (SOC) regardless of the practices that are being applied or the condition of the vegetation. Conversely, periods of above normal rainfall will likely result in increased soil carbon storage. Given the overriding influence of drought, its impact on plant growth and likely effect of carbon uptake, the CCX Rangeland Protocol contains the following rules on soil carbon in projects undergoing drought.

Agricultural Drought

For the purposes of the CCX Rangeland Protocol, drought occurs when soil water deficits limit vegetation production below a long term average.

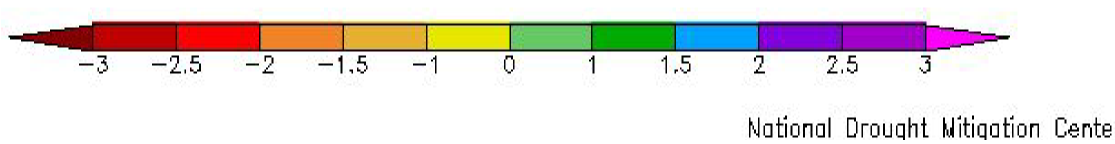
Drought conditions in the United States are monitored and tracked on the NDMC website operated by the University of Nebraska at Lincoln. http://www.drought.unl.edu/ The National Drought Map is updated weekly and drought conditions are reported on a county by county basis. Specifically, verifiers and aggregators may use the Drought Monitoring tool by county available at the following link:
http://drought.unl.edu/monitor/spi-dailygridded.html

The drought severity classification table below shows the ranges for each indicator for each dryness level using the Standardized Precipitation Index (SPI). The SPI calculation for any location is based on the long-term precipitation record for a desired period. The SPI can be computed for different time scales, can provide early warning of drought and help assess drought severity, and is less complex than some other indicators.

SPI Values	
2.0+	extremely wet
1.5 to 1.99	very wet
1.0 to 1.49	moderately wet
-.99 to .99	near normal
-1.0 to -1.49	moderately dry
-1.5 to -1.99	severely dry
-2 and less	extremely dry

Drought Severity Classification http://www.drought.unl.edu/dm/classify.htm			
Category	**Description**	**Possible Impacts**	**Standardized Precipitation Index (SPI)**
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	-0.5 to -0.7
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	-0.8 to -1.2
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-1.3 to -1.5 (Light Orange on Color Scale)
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-1.6 to -1.9 (Dark Orange on Color Scale)
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-2.0 or less (Dark Red, Red, Bright Red on Color Scale)

SPI color-coded Drought Scale,
National Drought Monitoring Center-Daily Gridded SPI
http://drought.unl.edu/monitor/spi-dailygridded.html



I. CCX Treatment of Rangeland under Drought Conditions

The following applies to Drought-related actions.

1. Rangelands enrolled must have drought management as a part of their overall formal grazing plan, preferably with defined management responses (e.g. utilization rates of < 50%) to drought triggers described by the drought classification index.

2. Project land that was classified as -1 to -3 or lower on the SPI Color-coded drought scale for at least three consecutive years beginning January 1, 1997 through December 31, 2002 may be enrolled as degraded rangeland (see above chart for descriptions).

3. During the CCX program, projects will continue to accrue credits at the specified rate according to LRR during years of drought (-1 to -3 or lower on the SPI Color-coded drought scale). At the end of CCX Phase II (2010), projects that are classified as being at drought levels of -1 to -3 or lower in any two or more consecutive years of the CCX program will have credits for those years deducted from the carbon reserve pool (20% per year in drought). Drought status will be determined by county or crop reporting district 12 month SPI from November- October via the following on-line tool: http://drought.unl.edu/monitor/spi-dailygridded.html http://www.drought.unl.edu/monitor/archivedspi.htm

4. If a project has credits deducted from the carbon reserve pool due to drought, and has ADDITIONAL non-compliance, the appropriate amount of CFI's will be deducted from the pool's 2010 offsets in order to again establish the full 20% carbon reserve.

5. Enrolled Project land credited under the non-degraded, improved management credit rates will not change status once enrolled in CCX, regardless of drought conditions.

LRR B - Counties that Qualify for Rangeland Soil Carbon Management Offsets

IDAHO	OREGON	WASHINGTON
Ada	Baker	Adams
Bannock	Crook	Asotin
Bear Lake	Deschutes	Benton
Bingham	Gilliam	Chelan
Blaine	Jefferson	Columbia
Bonneville	Morrow	Douglas
Butte	Sherman	Franklin
Camas	Umatilla	Garfield
Canyon	Wasco	Grant
Caribou	Wheeler	Kittitas
Cassia		Klickitat
Clark		Lincoln
Elmore		Okanogan
Fremont		Spokane
Gem		Walla Walla
Gooding		Whitman
Jefferson		Yakima
Jerome		
Latah		
Lemhi		
Lewis		
Lincoln		
Madison		
Minidoka		
Nez Perce		
Payette		
Power		
Teton		
Washington		

LRR C - Counties that Qualify for Rangeland Soil Carbon Management Offsets

CALIFORNIA		
Alameda	Marin	Santa Clara
Butte	Merced	Santa Cruz
Calaveras	Monterey	Solano
Colusa	Napa	Sonoma
Contra Costa	Orange	Stanislaus
Fresno	Sacramento	Sutter
Glenn	San Benito	Tehama
Kern	San Diego	Ventura
Kings	San Joaquin	Yolo
Lake	San Luis Obispo	Yuba
Los Angeles	San Mateo	
Madera	Santa Barbara	

LRR E - Counties that Qualify for Rangeland Soil Carbon Management Offsets

COLORADO	**IDAHO**	**MONTANA**
Alamosa	Adams	Beaverhead
Archuleta	Benewah	Broadwater
Boulder	Boise	Carbon
Broomfield	Bonner	Cascade
Chaffee	Boundary	Deer Lodge
Clear Creek	Clearwater	Flathead
Conejos	Custer	Gallatin
Costilla	Idaho	Glacier
Custer	Kootenai	Granite
Douglas	Shoshone	Jefferson
Eagle	Valley	Judith Basin
El Paso		Lake
Fremont		Lewis and Clark
Garfield		Lincoln
Gilpin		Madison
Grand		Meagher
Gunnison		Mineral
Hinsdale		Missoula
Huerfano		Park
Jackson		Powell
Jefferson		Ravalli
Lake		Sanders
Larimer		Silver Bow
Mineral		Stillwater
Ouray		Sweet Grass
Park		Teton
Pitkin		
Rio Grande		
Routt		
Saguache		
San Juan		
Summit		
Teller		

LRR E - Counties that Qualify for Rangeland Soil Carbon Management Offsets

NEW MEXICO	**OREGON**	**UTAH**
Colfax	Grant	Cache
Rio Arriba	Union	Carbon
Taos	Wallowa	Daggett
		Duchesne
		Morgan
		Rich
		Summit
		Utah
		Wasatch

LRR E - Counties that Qualify for Rangeland Soil Carbon Management Offsets

WASHINGTON	**WYOMING**
Ferry Pend Oreille Stevens	Big Horn Hot Springs Lincoln Park Sublette Teton Uinta

LRR F - Counties that Qualify for Rangeland Soil Carbon Management Offsets

MONTANA	NORTH DAKOTA		SOUTH DAKOTA
Blaine	Adams	Ramsey	Aurora
Chouteau	Barnes	Ransom	Beadle
Daniels	Benson	Renville	Brown
Hill	Bottineau	Richland	Brule
Liberty	Burke	Rolette	Buffalo
McCone	Burleigh	Sargent	Campbell
Phillips	Cass	Sheridan	Charles Mix
Pondera	Cavalier	Sioux	Corson
Richland	Dickey	Stark	Davison
Roosevelt	Divide	Steele	Douglas
Sheridan	Dunn	Stutsman	Edmunds
Toole	Eddy	Towner	Faulk
Valley	Emmons	Traill	Hand
Wibaux	Foster	Walsh	Hughes
	Golden Valley	Ward	Hyde
	Grand Forks	Wells	Jerauld
	Grant	Williams	McPherson
	Griggs		Perkins
	Hettinger		Potter
	Kidder		Sanborn
	LaMoure		Spink
	Logan		Sully
	McHenry		Walworth
	McIntosh		Ziebach
	McKenzie		
	McLean		
	Mercer		
	Morton		
	Mountrail		
	Nelson		
	Oliver		
	Pembina		
	Pierce		

LRR G - Counties that Qualify for Rangeland Soil Carbon Management Offsets

COLORADO	**MONTANA**	**NEBRASKA**
Adams	Big Horn	Arthur
Arapahoe	Carter	Banner
Bent	Custer	Blaine
Cheyenne	Dawson	Box Butte
Crowley	Fallon	Boyd
Denver	Fergus	Brown
Elbert	Garfield	Cherry
Kiowa	Golden Valley	Dawes
Kit Carson	Musselshell	Garden
Las Animas	Petroleum	Garfield
Lincoln	Powder River	Grant
Morgan	Prairie	Holt
Otero	Rosebud	Hooker
Prowers	Treasure	Keya Paha
Pueblo	Wheatland	Kimball
Washington	Yellowstone	Knox
Weld		Logan
		Loup
		McPherson
		Morrill
		Rock
		Scotts Bluff
		Sheridan
		Sioux
		Thomas
		Wheeler

LRR G - Counties that Qualify for Rangeland Soil Carbon Management Offsets

NEW MEXICO	**NORTH DAKOTA**	**SOUTH DAKOTA**	**WYOMING**
Chaves	Billings	Bennett	Campbell
De Baca	Bowman	Butte	Converse
Guadalupe	Slope	Custer	Crook
Lincoln		Dewey	Goshen
Mora		Fall River	Johnson
Quay		Gregory	Laramie
San Miguel		Haakon	Niobrara
Santa Fe		Harding	Platte
Torrance		Jackson	Sheridan
		Jones	Weston
		Lawrence	
		Lyman	
		Meade	
		Mellette	
		Pennington	
		Shannon	
		Stanley	
		Todd	
		Tripp	

LRR H - Counties that Qualify for Rangeland Soil Carbon Management Offsets

COLORADO	**KANSAS**	**KANSAS**
Baca	Barber	McPherson
Logan	Barton	Meade
Phillips	Butler	Mitchell
Sedgwick	Chase	Morris
Yuma	Cheyenne	Morton
	Clark	Ness
	Clay	Norton
	Cloud	Osage
	Comanche	Osborne
	Cowley	Ottawa
	Decatur	Pawnee
	Dickinson	Phillips
	Edwards	Pottawatomie
	Elk	Pratt
	Ellis	Rawlins
	Ellsworth	Reno
	Finney	Republic
	Ford	Rice
	Geary	Riley
	Gove	Rooks
	Graham	Rush
	Grant	Russell
	Gray	Saline
	Greeley	Scott
	Greenwood	Sedgwick
	Hamilton	Seward
	Harper	Sheridan
	Harvey	Sherman
	Haskell	Smith
	Hodgeman	Stafford
	Jewell	Stanton
	Kearny	Stevens
	Kingman	Sumner
	Kiowa	Thomas
	Lane	Trego
	Lincoln	Wabaunsee
	Logan	Wallace
	Marion	Washington
	Marshall	Wichita

LRR H - Counties that Qualify for Rangeland Soil Carbon Management Offsets

NEBRASKA	NEW MEXICO	OKLAHOMA
Adams	Curry	Alfalfa
Buffalo	Harding	Beaver
Butler	Lea	Beckham
Chase	Roosevelt	Blaine
Cheyenne	Union	Caddo
Clay		Canadian
Custer		Cimarron
Dawson		Cleveland
Deuel		Comanche
Dundy		Cotton
Fillmore		Custer
Franklin		Dewey
Frontier		Ellis
Furnas		Garfield
Gosper		Grant
Greeley		Greer
Hall		Harmon
Hamilton		Harper
Harlan		Jackson
Hayes		Jefferson
Hitchcock		Kay
Howard		Kingfisher
Jefferson		Kiowa
Kearney		Logan
Keith		Major
Lincoln		McClain
Merrick		Noble
Nuckolls		Oklahoma
Perkins		Pawnee
Phelps		Payne
Polk		Roger Mills
Red Willow		Texas
Saline		Tillman
Seward		Washita
Sherman		Woods
Thayer		Woodward
Valley		
Webster		
York		

LRR H - Counties that Qualify for Rangeland Soil Carbon Management Offsets

TEXAS	
Andrews	Hutchinson
Archer	Jack
Armstrong	Jones
Bailey	Kent
Baylor	King
Borden	Knox
Briscoe	Lamb
Brown	Lipscomb
Callahan	Lubbock
Carson	Lynn
Castro	Martin
Childress	Midland
Clay	Mitchell
Cochran	Montague
Coke	Moore
Coleman	Motley
Collingsworth	Nolan
Concho	Ochiltree
Cottle	Oldham
Crosby	Palo Pinto
Dallam	Parmer
Dawson	Potter
Deaf Smith	Randall
Dickens	Roberts
Donley	Runnels
Ector	Scurry
Fisher	Shackelford
Floyd	Sherman
Foard	Stephens
Gaines	Stonewall
Garza	Swisher
Gray	Taylor
Hale	Terry
Hall	Throckmorton
Hansford	Tom Green
Hardeman	Wheeler
Hartley	Wichita
Haskell	Wilbarger
Hemphill	Yoakum
Hockley	Young
Howard	

Appendix 9.4 CCX Ozone-Depleting Substances Destruction Project Guidelines

Introduction

Production of chlorofluorocarbons (CFCs), halons, and other ozone depleting substances (ODS) has been phased out in the U.S. and in all member countries under the Montreal Protocol; phaseout of hydrochlorofluorocarbons (HCFCs) is in progress. In addition to depleting stratospheric ozone, these chemicals have global warming potentials relative to CO_2 ranging between 500 and 10,000 when eventually emitted from equipment and storage stockpiles. While production of these chemicals has been or is being ended, there are no regulations or market incentives to ensure recovery and destruction of the chemicals contained in older appliances, commercial air conditioning and refrigeration equipment, insulation foam, fire fighting systems, storage cylinders, and other “banks”.

For the US in 2007, EPA estimates that accessible quantities of ODS contained in equipment represent over 1,400 million metric tons of CO_2 equivalent ($MMTCO_2Eq$). Accessible quantities of ODS that have been phased out of production in the U.S. account for approximately 330 $MMTCO_2Eq$. EPA estimates that by 2010, 13% of this amount will be emitted if not recovered and destroyed or converted. Subsection A presents historical and projected estimates for accessible quantities of ODS by ODS type for the years 2000 to 2030. Additional quantities of ODS (e.g., CFC-12, halon 1301) are contained in bulk storage (pressurized 30 pound cylinders, 250 gallon tanks, or large ISO tanks). Some stockpiled ODS could be made available for destruction, particularly if incentives were provided to the owners of such stockpiles.

This protocol summarizes procedures to measure and verify greenhouse gas emission reductions resulting from the destruction of ODS for the Chicago Climate Exchange (CCX).

Definitions

Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol): An international treaty established in 1987, since amended, that stipulates phase out schedules for production and consumption of compounds that deplete ozone in the stratosphere.

U.S. Environmental Protection Agency (EPA): EPA is responsible for implementing regulations and programs under Title VI of the Clean Air Act Amendments of 1990 to meet U.S. commitments for protecting the ozone layer as agreed to under the Montreal Protocol. EPA also issues regulations and conducts enforcement activities for entities covered under the Resource Conservation and Recovery Act, including hazardous waste destruction facilities in the US.

Ozone-depleting substances (ODSs): Compounds including chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, carbon tetrachloride, and methyl chloroform (see Subsection B for a complete list) that, once emitted to the atmosphere, significantly deplete the stratospheric ozone layer that shields the planet from damaging UV-B radiation. The production and consumption of these compounds are controlled under the Montreal Protocol and CAAA regulations.

ODS Controlled Substance means a substance listed in Appendix B, whether existing alone or in a mixture. It excludes any controlled substance or mixture which is in a manufactured product other than a container used for the transportation or storage of that substance.

Production means the amount of ODS controlled substance produced minus the amount entirely used as feed stock in the manufacture of other chemicals. The amount recycled or reused is not to be considered as “production”.

Imports means the importation of ODS controlled substances as listed in Appendix B.

Clean Air Act Amendments (CAAA): Title VI, Stratospheric Ozone Protection, of the CAAA authorizes EPA to manage the phaseout of ODS. Among regulations established by EPA are requirements for safe handling and disposal of ODS and prohibitions on intentional venting or release of ODS into the atmosphere, and requirements governing the import of recycled ODS. Title V of the CAAA authorizes EPA to issue Operating Permits that contain emission limits for the release of air pollutants, including hazardous air pollutants (HAPs), by hazardous waste destruction facilities.

Resource Conservation and Recovery Act (RCRA): Regulates compounds classified as hazardous waste as well as the facilities that handle these wastes through a permitting and enforcement program.

Maximum Achievable Control Technology (MACT): RCRA-permitted hazardous waste facilities that operate HWCs are also required by the MACT standard under the CAAA to obtain Title V Operating Permits as a hazardous air pollutant (HAP) emission source.

Hazardous Waste Combustors (HWCs): Commercial destruction facilities that destroy hazardous waste, including ODS, for outside sources.

Destruction Removal Efficiency (DRE): A measure of a destruction unit’s efficiency in destroying specified compounds.

Applicability

This protocol applies to ODS recovered from equipment or stockpiles and submitted for destruction to a facility that commercially destroys ODS for outside parties. In the U.S., commercial destruction facilities can be categorized as follows:

- Incinerators
  - Rotary kilns
  - Fixed hearth units
  - Liquid injection units
- Industrial furnaces

- Cement kilns
- Lightweight aggregate kilns
- Plasma technologies
  - Argon plasma arc units

Only ODS whose production has been completely phased out under Title VI of the CAAA (currently including all CFCs, halons, carbon tetrachloride, methyl chloroform, hydrobromofluorocarbons, and HCFC-141b) are eligible for destruction under this protocol. *For international stocks, the Montreal Protocol member country must have phased out the production and importation of the ODS (except for critical use exemptions as defined by the Montreal Protocol) as listed in Appendix B for it to be eligible for destruction under this protocol.* Destruction of the ODS must be in compliance with all applicable requirements under the CAAA and RCRA related to ODS safe handling and disposal and operation of destruction facilities described below. Similarly, only ODS that is imported into the U.S. is eligible for destruction under this protocol that is imported into the U.S. in accordance with applicable requirements under the CAAA.

Federal Regulations for ODS Destruction Facilities

Under the authority of the **CAAA**, the **stratospheric ozone protection regulations** (40 CFR Part 82, Subpart A) establish the following definitions relating to the destruction of controlled substances:[38]

- "*Destruction* means the expiration of a controlled substance to the destruction efficiency actually achieved, unless considered completely destroyed as defined in this section. Such destruction does not result in a commercially useful end product and uses one of the following controlled processes approved by the Parties to the Protocol:
  (1) Liquid injection incineration;
  (2) Reactor cracking;
  (3) Gaseous/fume oxidation;
  (4) Rotary kiln incineration;
  (5) Cement kiln;
  (6) Radio frequency plasma; or
  (7) Municipal waste incinerators only for the destruction of foams."
- "*Completely destroy* means to cause the expiration of a controlled substance at a destruction efficiency of 98 percent or greater using one of the destruction technologies approved by the Parties."

In other words, the stratospheric ozone protection regulations require the use of one of the technologies approved by the Parties to the Montreal Protocol when destroying a controlled substance. Additionally, if the substance is to be considered "completely destroyed" as defined in the regulations, it must be destroyed to a 98 percent destruction efficiency.

In addition to the stratospheric ozone protection regulations for ODS under the Clean Air Act, ODS that are classified as hazardous wastes are also regulated under **RCRA**. Therefore, facilities that operate hazardous waste storage tanks, manage hazardous waste containers, and operate hazardous waste treatment units are required to have RCRA permits, which regulate what specific hazardous wastes the facilities are permitted to receive and store, and in what quantities.

According to 40 CFR Part 261, Subpart D, ODS (or ODS-containing waste) may be classified as hazardous wastes if they fall under one of the following waste categories:

- Wastes from non-specific sources (Code F);
- Commercial chemical products (Code U);
- Characteristic wastes (Code D); or
- Wastes from specific sources (Code K).

Carbon tetrachloride, methyl chloroform, and all CFCs and HCFCs may be classified as Code **F** hazardous wastes if they have been used as solvents prior to disposal. While carbon tetrachloride, methyl chloroform, methyl bromide, trichlorofluoromethane (CFC-11), and dichlorodifluoromethane (CFC-12) have designated **U** waste codes, this code is limited to container residues and products that were manufactured but never used. Therefore, refrigerants removed from equipment (which are not classified as hazardous wastes)[39] and used solvents (some of which do fall under waste Code F) *would not* fall under hazardous waste Code U; a controlled substance that was manufactured and never used *would* be considered a Code U waste if it was discarded or intended to be discarded. ODS-contaminated wastes which may be generated from specific sources, such as the production of carbon tetrachloride, may be classified under several **K** waste codes. However, because these waste codes apply mainly to wastes/residues from the production of various chemicals, they will not apply to controlled substances being sent for destruction. Carbon tetrachloride is designated under waste code **D**019; thus, if an extract from a representative sample of a solid waste contains a concentration of carbon tetrachloride equal to or greater than the regulatory threshold level of 0.5 mg/L, it is considered a hazardous waste. Additionally, used ODS contaminated with any of the other Code D chemicals are considered hazardous wastes if an extract contains any of the contaminants listed in 40 CFR 261.24 at a concentration equal to or greater than the specified values.

[38] According to 40 CFR 261.4(b)(12), refrigerants that meet the following definition are exempt from classification as hazardous wastes: "used chlorofluorocarbon refrigerants from totally enclosed heat transfer equipment, including mobile air conditioning systems, mobile refrigeration, and commercial and industrial air conditioning and refrigeration systems that use chlorofluorocarbons as the heat transfer fluid in a refrigeration cycle, provided the refrigerant is reclaimed for further use". According to 56 FR 5913, this exemption includes CFC and HCFC refrigerants.

Table 1 summarizes the RCRA hazardous waste codes that may apply to controlled substances (i.e., not including ODS byproducts or ODS-containing wastes from chemical manufacture).

Table 1: RCRA Hazardous Waste Codes for Selected ODS

Chemical Name	Hazardous Waste Codes			
	U[a]	F	D	K
CFC-11 (Trichlorofluoromethane)	U121	F001, F002	-	-
CFC-12 (Dichlorodifluoromethane)	U075	F001	-	-
Other CFCs and HCFCs	-	F001	-	-
Carbon Tetrachloride	U211	F001	D019	-
Methyl Chloroform (1,1,1-trichloroethane)	U226	F001, F002	-	-
Methyl Bromide	U029	-	-	-

[a] Code U only applies to the controlled substances listed above if they were manufactured and subsequently disposed of without ever being used.

RCRA-permitted hazardous waste facilities that operate hazardous waste combustors (HWCs) are also required by the **MACT** standard under the **CAAA** to obtain a Title V Operating Permit as a hazardous air pollutant (HAP) emission source. Title V Operating Permits contain emission limits for the release of air pollutants, including HAPs, from the combustion of hazardous wastes to ensure the protection of human and environmental health. Under the MACT standards, when hazardous wastes are to be destroyed by way of combustion, the combustion unit must adhere to a minimum 99.99 percent DRE and also meet the air emission limits listed in 40 CFR 63.1216 – 63.1221. The air emission limits relevant to ODS destruction include limits for dioxins and furans, PM, total chlorine (HCl and Cl_2), and CO. Additional operating limitations for HWCs, including maximum hazardous waste feed rates and ranges of hazardous waste composition (e.g., maximum feed rate of chlorine to the unit), are established on a unit-specific basis by the Title V Operating Permit writers based on a review of the unit design, waste characterization data, and performance test results.

At this time, all of the known commercial destruction facilities, with the exception of one plasma arc unit, are RCRA-permitted HWCs and, therefore, must meet all regulatory requirements under the CAAA and RCRA, including meeting a 99.99 percent DRE[40] when destroying hazardous

[40] According to the United Nations Environmental Programme Technology and Economic Assessment Panel (TEAP), DE is a more comprehensive measure of destruction than DRE as it includes emissions of undestroyed chemical from all points (e.g., stack gases, fly ash, scrubber, water, bottom ash), while DRE includes emissions of undestroyed chemical from the stack gas only. However, "because of the relatively volatile nature of ODS and because, with the exception of foams, they are generally introduced as relatively clean fluids, one would not expect a very significant difference between DRE and DE". This information along with reviewed ODS destruction technologies and recommendations are available from the TEAP Report of the Task Force on Destruction Technologies (2002) available at http://www.teap.org.

waste. While the 99.99 percent DRE is not required for ODS that are not classified as hazardous wastes (e.g., halons and most CFCs and HCFCs), research has indicated that it is probable that all ODS will be destroyed to at least this DRE when sent to a permitted HWC.

Regulations Governing Import of Used/Recycled ODS

EPA requires that imports of ODS into the U.S. receive approval based on documentation specified in the Code of Federal Regulations at 82.13(g)(2) and 82.24(c)(3). Importers must submit to EPA a petition with the following information:

- Name and quantity of ODS
- Identity and addresses of importer and of all previous source facilities from which ODS was recovered
- Detailed description and date of previous use of ODS at each source facility including details of the equipment using the ODS
- Identity and address of entity that recovered ODS at source facility and of as of all persons whom ODS was transferred or sold after it was recovered
- Expected date of shipment and vessel transporting ODS
- Description of intended use and identity and address of U.S. purchaser
- Identity and addresses of U.S. and foreign reclamation facility
- An export license from country of export and, if recovered in another country, the export license from that country;
- Statement from reclamation facility that it will process ODS to specifications of 40 CFR 82
- Certification of accuracy

These petitioning requirements may be revised to allow companies to more easily import ODS specifically for destruction.

C. Federal Regulations on Venting of ODS

Demand for ODS to service existing equipment has remained steady since the production of halons and CFCs ended in 1994 and 1996, respectively, and this demand is likely to continue for equipment using HCFCs. U.S. policy has been to encourage the transition from the use of ODS to alternatives, to allow recycling to meet needs of critical users, and to ensure proper disposal to prevent unnecessary emissions. Section 608 of the CAAA prohibits the known venting of ODS while maintaining, servicing, repairing, and disposing of ODS containing equipment. There are no current federal, state, or local regulations in place that require equipment decommissioning and destruction of ODS. Therefore, destruction of ODS, that would otherwise be emitted, exceeds current venting regulations. If new regulations are issued in the future that require ODS destruction, CCX offset projects must demonstrate additional emission reductions beyond compliance.

Eligibility

To be eligible, any ODS destruction must be conducted at a facility that meets all CAAA and RCRA regulatory requirements. Facilities that destroy imported ODS must demonstrate that the material was imported into the U.S. in accordance with CAAA requirements.

CCX eligibility requirements for crediting ODS destruction as *Exchange Fluorocarbon Destruction Offsets (XFDOs)* are as follows:

- CFCs, halons, carbon tetrachloride, methyl chloroform, hydrobromofluorocarbons, and HCFC-141b destroyed after January 1, 2007 can be registered and traded on the CCX.

In order for a project to be deemed eligible, the project activity cannot be undertaken to come into compliance with existing or imminent legislation. Currently, ODS destruction would exceed federal, state, and/or local requirements in the U.S. governing GHG emissions, therefore, any destruction project involving ODS that has been phased out of production will be considered eligible. However, because new regulations may be implemented in the future, CCX members must demonstrate that federal, state and/or local regulations do not require ODS destruction when implementing specific, individual projects.

While not required for project eligibility, recommended best management practices should be followed to reduce potential losses and ODS emissions while collecting and transporting ODS for destruction. Subsection C presents additional information on these recommended best management practices.

Protocol for Measuring and Recording ODS Destruction

For measuring and recording ODS destruction, CCX offset members shall employ the measurement and recordkeeping procedures described in this section. ODS destruction amounts shall be determined by the amount of ODS input into the destruction unit, less that emitted through the stack gas, which is determined based on the unit's DRE. Exchange Offsets (XOs) will be determined based on the amount of ODS destroyed, assuming that in the absence of destruction, 100 percent of the ODS would have eventually been emitted. This approach for granting XOs for the total amount of ODS destroyed is based on the fact that current destruction practices are minimal, as the majority of surplus ODS in the market is currently being reclaimed and used in equipment (which leads to slow leakage or accidental release), rather than being destroyed. In addition, the extra costs required to destroy ODS, versus these other options, generally prevent owners from undertaking destruction projects. Exceptions to these are owners of ODS that may be too contaminated to reuse or owners motivated to prevent emissions altogether. Therefore, any ODS destruction activity can be considered "beyond common practice", and therefore additional.

Measurement

Because there is no cost-effective way to continuously measure ODS emissions from stack gases during destruction processes, the DRE should be used to estimate the amount of ODS that is not destroyed and therefore emitted from the stack gases.

Under the MACT standards, DREs achieved by destruction units are calculated based on measured feed rates and stack gas emissions rates occurring during performance tests conducted under controlled conditions using representative compounds. Facility operators and permitting agencies then determine that the HWCs are achieving the applicable DRE by determining that the units are being operated within the permitted range of operating parameters. This permitted range of parameters is developed based on the conditions under which performance tests for the HWC were conducted.

Therefore, the DRE recorded during the performance test should be assumed to apply when the actual supply of ODS is destroyed, provided that the unit was being operated within the permitted range of operating parameters (e.g., waste feed rate, combustion temperature).

Recordkeeping

The recordkeeping requirements for an ODS destruction project are based on the pre-existing recordkeeping and reporting requirements for ODS destruction facilities under the CAAA.

Under Title V of the CAAA, hazardous waste combustor facility operators are required to record information to document and maintain compliance with MACT standard Subpart EEE regulations. Specifically, HWCs are required, under 40 CFR 63.1209, to continuously monitor (1) total hydrocarbon or carbon monoxide emissions in exhaust gas using a continuous emission monitoring system (CMS) and (2) the waste feed rate. Under 40 CFR 63.1206 and 63.1207, HWCs must document compliance with emission limits (including DRE) and demonstrate performance of their CMS by conducting comprehensive performance tests every five years. Additionally, under 40 CFR 62.1211, facilities are required to maintain information on site to document and maintain compliance with MACT standard Subpart EEE regulations (including data recorded by CMS) and make operating records available for on-site inspection by the EPA.

Under Title VI of the CAAA, ODS destruction facilities must provide the following reports:

A report to EPA with the names and quantities of all ODS destroyed during each calendar year, as per 40 CFR 82.13(m). Subsection D presents an example of the reporting form facilities can use to report ODS destruction to EPA;

A one-time report to EPA, which must include the following information as per 40 CFR 82.13(j):

- the destruction unit's DRE;
- the methods used to record the volume destroyed;
- the methods used to record DRE; and

- the names of other relevant federal or state regulations that may apply to the destruction process.

A destruction verification document to the producer/importer from whom they purchased/received the ODS, which must include the following information as per 40 CFR 82.13(k):

- the identity and address of the person intending to destroy controlled substances;
- an indication of whether those controlled substances will be "completely destroyed" or less than completely destroyed, in which case they must provide the DRE;[41]
- the period of time over which the person intends to destroy the controlled substances; and
- the signature of the verifying person.

If any aspects of this verification change, a revised copy of the verification must be submitted to producer/importer. Subsection E presents an example destruction verification document..

Based on these pre-existing regulatory requirements, the following project-specific records are to be kept in order to verify ODS destruction:

- Name of ODS destruction project;
- Amounts and types of ODS and dates placed into destruction unit;
- Type of destruction technology used;
- Copies of destruction facility's one-time repot to EPA as required under 40 CFR 82.13(j);
- Copies of the destruction verification document as required under 40 CFR 82.13(k);
- Copies of the CMS data recorded by the destruction facility during the destruction of the ODS, as required under 40 CFR 63.1209 and 63.1211;
- Copies of the calculations done to determine the total amount of ODS destroyed;
- Gas chromatograph and mass spectrometer test results of material batched that determines the ODS components by mass weight/percentage as sampled at the destruction facility:
- For destruction of imported ODS, copy of approved petition to import the used ODS into the U.S.; and
- Records of third-party verification of emission monitoring and procedures.

The above-listed records need to be kept readily accessible and on-site (or with the local field office responsible for the site) for at least 2 years after the date that ODS emissions reductions for the project have been recorded at the CCX. These records may be required in Project Reports by CCX.

[41] "Completely destroy," as defined in 40 CFR 82.3, means "to cause the expiration of a controlled substance at a destruction efficiency of 98 percent or greater, using one of the destruction technologies approved by the Parties."

Use of Measured Data and Factors to Calculate Emission Offsets

The following equation should be used to calculate the total amount of ODS destroyed, based on the amount fed into the destruction unit and the DRE:

Amount Fed Into Destruction Unit * DRE = Amount Destroyed

As the total amounts of ODS destroyed are considered ODS emissions savings, they can be converted to XOs using the direct global warming potential (GWP) of the ODS less 25%. Direct GWP values should be based on the most up-to-date estimates (see Subsection F for current values).

Eligible offset projects will be issued XOs on the basis of the entire mitigation tonnage realized less 25%. The vintage year assigned to the XOs will correspond to the year in which ODS destruction occurs. The entity that bears the entire costs of destroying the ODS will have clear and undisputed legal ownership of the XOs created by the offset project.

Third Party Verification Requirements

Verification of ODS destruction projects shall be conducted in accordance with the provisions contained in Chapter 9 and 10 of the CCX Rulebook and as prescribed by the CCX Committee on Offsets.

Verification Checklist for Offset Members

- Confirm eligibility
    - Confirm no pre-existing federal, state, or local regulations requiring destruction
    - Confirm material phase out
- Develop specific destruction plan
    - Arrange for ODS destruction with destruction facility
    - List measured data and documentation to be verified by auditor
- Calculate amounts destroyed/emission reductions
    - List and reference assumptions and conversion factors used
    - Prepare a spreadsheet to calculate amounts destroyed, emissions reductions and XOs
    - Perform QA/QC procedures
- Prepare overall report
    - Present cumulative emission savings
    - Compare CMS data from destruction to permitted levels to prove that DRE standard was met

Subsection A: Estimated ODS Accessible Banks in U.S. Equipment

Table A1: Total ODS Accessible Banks in U.S. Equipment, By ODS Type (Million Metric Tons)

Year	CFC-11	CFC-12	CFC-115	CFC Totals	Halon 1211	Halon 1301	Halon Totals	HCFC-22	HCFC-123	HCFC-124	HCFC-141b	HCFC-142b	HCFC Totals	Overall Totals
2000	0.0134	0.0844	0.0037	0.1015	0.0074	0.0154	0.0229	0.5167	0.0125	0.0004	0.0000	0.0002	0.5297	**0.6541**
2005	0.0094	0.0270	0.0020	0.0385	0.0016	0.0135	0.0151	0.5928	0.0195	0.0001	0.0000	0.0000	0.6123	**0.6659**
2010	0.0065	0.0136	0.0008	0.0210	0.0014	0.0050	0.0064	0.5490	0.0251	0.0000	0.0000	0.0000	0.5742	**0.6016**
2015	0.0018	0.0030	0.0001	0.0049	0.0017	0.0029	0.0045	0.3546	0.0298	0.0000	0.0000	0.0000	0.3845	**0.3939**
2020	0.0000	0.0000	0.0000	0.0000	0.0019	0.0015	0.0034	0.1623	0.0271	0.0000	0.0000	0.0000	0.1895	**0.1929**
2025	0.0000	0.0000	0.0000	0.0000	0.0022	0.0015	0.0037	0.0371	0.0207	0.0000	0.0000	0.0000	0.0578	**0.0615**
2030	0.0000	0.0000	0.0000	0.0000	0.0026	0.0016	0.0042	0.0117	0.0145	0.0000	0.0000	0.0000	0.0262	**0.0304**

[a] The quantity of accessible ODS contained in U.S. banks is estimated from the *U.S. EPA Vintaging Model* (Version VM IO 3-1-07). These estimates include ODS in fire protection and refrigeration/AC equipment in any given year. It is assumed that the amount of ODS recoverable from this equipment is equal to the full equipment charge minus the average annual loss rate (from leakage and service events) times the charge size.

Table A2: Total ODS Accessible Banks in U.S. Equipment, By ODS Type (Direct GWP-Weighted Million Metric Tons [MMT CO_2 Eq])[a,b]

Year	CFC-11	CFC-12	CFC-115	CFC Totals	Halon 1211	Halon 1301	Halon Totals	HCFC-22	HCFC-123	HCFC-124	HCFC-141b	HCFC-142b	HCFC Totals	Overall Totals
2000	63	905	27	995	14	108	122	920	1	0	0	0	921	**2,038**
2005	44	290	15	349	3	95	98	1,055	1	0	0	0	1,057	**1,503**
2010	31	146	6	182	3	35	38	977	2	0	0	0	979	**1,199**
2015	9	32	1	41	3	20	23	631	2	0	0	0	633	**698**
2020	0	0	0	0	4	11	14	289	2	0	0	0	291	**305**
2025	0	0	0	0	4	10	14	66	2	0	0	0	68	**82**
2030	0	0	0	0	5	11	16	21	1	0	0	0	22	**38**

[a] Source: *U.S. EPA Vintaging Model* (Version VM IO 3-1-07).
[b] The amount of ODS in Table A1 was converted into million metric tons of carbon dioxide equivalent [MMT CO_2 Eq] using direct global warming potentials (GWP) published in the *Special Report on Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons* (IPCC/TEAP 2006).

Subsection B: Common Ozone Depleting Substances and their Direct GWPs[42]

Class I	**Direct GWP (100yr)**	**Class II**	**Direct GWP (100yr)**
CFC-11 (Trichlorofluoromethane)	4,680	HCFC-22 (Monochlorodifluoromethane)	1,780
CFC-12 (Dichlorodifluoromethane)	10,720	HCFC-123 (Dichlorotrifluoroethane)	76
CFC-113 (1,1,2-Trichlorotrifluoroethane)	6,030	HCFC-124 (Monochlorotetrafluoroethane)	599
CFC-114 (Dichlorotetrafluoroethane)	9880	**HCFC-141b (Dichlorofluoroethane)**	713
CFC-115 (Monochloropentafluoroethane)	7250	HCFC-142b (Monochlorodifluoroethane)	2,270
Halon 1211 (Bromochlorodifluoromethane)	1,860	HCFC-225ca (Dichloropentafluoropropane)	120
Halon 1301 (Bromotrifluoromethane)	7,030	HCFC-225cb (Dichloropentafluoropropane)	586
Halon 2402 (Dibromotetrafluoroethane)	1,620		
Carbon Tetrachloride	1,380		
Methyl Chloroform (1,1,1-trichloroethane)	144		
Methyl Bromide	5		

Source: IPCC/TEAP. 2006. Special Report on Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons. p. 162. Available online at: http://www.ipcc.ch/pub/reports.html

[42] Compounds in bold have been phased out under Title VI of the CAAA and are, therefore, eligible for destruction under this protocol.

Subsection C: Recommended Best Management Practices

During the lifetime of ODS, a certain amount of emissions are inevitable. During storage, ODS stored in cylinders can be emitted if the cylinder fails or if the cylinder possesses a faulty valve; ODS stored in pressure vessels can leak due to the accidental failure of the relief valve (i.e., a valve installed to prevent tank explosion in case of a large pressure change). During transfers of ODS from one container/equipment to another container, emissions can occur from hose leaks and from any residual ODS remaining in the hoses when they are disconnected. Additionally, a residual amount of ODS (also known as a heel) can remain in the "empty" source container/equipment.

Best practices should be employed to reduce these emissions as much as possible while preparing, collecting, and transporting ODS for destruction. By minimizing emissions prior to destruction, one ensures that the maximum amount of offsets will be earned. The following list outlines several best management steps that should be considered:

- Maintain in proper condition and regularly inspect storage equipment;
- Conduct transfers using dry-break couplings where possible and evacuate hoses prior to disconnection;
- Evacuate heels from the container using a vacuum and combine them with the remainder of the ODS.

The following publications can be used as references for additional information on best management practices for reducing emissions:

ARI. 2006. Responsible Use Guide for Minimizing Fluorocarbon Emission in Manufacturing Facilities. Air-Conditioning and Refrigeration Institute. Available online at http://www.epa.gov/ozone/snap/refrigerants/ARI_ResponsibleUseGuide.pdf.

EPA. 2002. Voluntary Code of Practice for the Reduction of Emissions of HFC & PFC Fire Protection Agents. Developed and endorsed by the Fire Equipment Manufacturers' Association (FEMA), the Fire Suppression Systems Association (FSSA), the National Association of Fire Equipment Distributors (NAFED), the Halon Alternatives Research Corporation, and the U.S. Environmental Protection Agency (EPA). March 2002. Available online at http://www.epa.gov/ozone/snap/refrigerants/vcopdocument.pdf.

Subsection D: Example Second-Party Destruction Annual Report

EPA U.S. Environmental Protection Agency
STRATOSPHERIC OZONE PROTECTION PROGRAM

CLASS I CONTROLLED SUBSTANCE
SECOND-PARTY DESTRUCTION
ANNUAL REPORT **(Sec 82.13)**

SECTION 1 COMPANY IDENTIFICATION

1.1 Date of Submission		**1.2 Year To Which This Report Applies**		**1.3** ☐ **Original Submittal** ☐ **Re-submittal**	
1.4 Have you submitted a one-time destruction report to EPA (per Sec 82.13)?			☐ Yes ☐ No	**Date Submitted:**	
1.5 Have you submitted a destruction verification to the producer or importer (per Sec 82.13)?			☐ Yes ☐ No	**Date Submitted:**	

1.6 Company Information

Company Name		
Street Address		
City	State	Zip Code

1.7 Company Contact Identification

Reporting Company Contact Person	Phone Number	Fax Number
E-mail Address		

1.8 Signature of Reporting Company Representative

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Name ____

Title ____

Signature ____ Date ________________

EPA U.S. Environmental Protection Agency
STRATOSPHERIC OZONE PROTECTION PROGRAM

CLASS I CONTROLLED SUBSTANCE
SECOND-PARTY DESTRUCTION ANNUAL REPORT (Sec 82.13)

SECTION 2 DESTRUCTION SUMMARY

2.1 Company Name	

2.2 Destruction Totals

A	B
Chemical Name	Second-Party Destruction of Class I Substance (kg)
CFC-11	
CFC-12	
CFC-13	
CFC-111	
CFC-112	
CFC-113	
CFC-114	
CFC-115	
Other CFCs (please specify)	
HBFCs (please specify)	
Halons (please specify)	
Carbon Tetrachloride	
Methyl Chloroform	
CBM	

Subsection E: Example Destruction Verification Form

Company X Name and Address Date

Customer Name and Address

Contract Number: 1234567

Company X has received [amount] of ODS including [type of ODS] for destruction.

In accordance with the contract, this material will be destroyed using our [name of destruction technology] unit.

The following information summarizes the planned destruction of the ODS:

Amount of ODS Destroyed: ______________________

ODS Type: ______________________

DRE: ______________________

Date for Destruction: ______________________

I certify, on behalf of Company X, that to the best of my knowledge, the above described will be destroyed in compliance with all applicable federal, state, and local laws, regulations, permits, and licenses.

Signature of Verifying Person, Date