CO_2 UTILIZATION IN CONCRETE – REMOVALS & REDUCTIONS – CARBONCURE – U.S. PROJECT #1

Document Prepared by CarbonCure Technologies Inc

Project Title	CO_2 Utilization in Concrete – Removals & Reductions – CarbonCure – U.S. Project #1
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

This project activity will utilize waste CO_2 which would have otherwise been emitted into the atmosphere, or atmospheric CO_2 which would otherwise be in the atmosphere and utilize that gas as a feedstock in the production of concrete. The project activities reduce greenhouse gas (GHG) emissions by mineralizing CO_2 via the production of concrete. This manufacturing process has the additional benefit of requiring less Portland cement, which further reduces emissions, because the cement production process is highly energy and carbon intensive. The project activity will take place at the location where the concrete is first manufactured (mixed with cement, water, aggregates, etc.). Existing facilities without CarbonCure equipment do not have any CO_2 injecting equipment and operate as standard concrete facilities emitting larger amounts of CO_2.

CO_2 is delivered and stored on-site at concrete facilities by a third-party supplier/distributor. CarbonCure hardware equipment controls and measures the amount of CO_2 utilized in mix designs. CO_2 is not treated or compressed while on-site but is stored in a gas/liquid phase fluid by the distributor, both forms of CO_2 are drawn from the tank to an injection nozzle in the concrete manufacturing process that injects CO_2.

As this is a grouped project with 100+ facilities various implementation dates are applicable for this verification, these will be provided to the VVB upon verification. All implementation dates for CarbonCure equipment have been retrofit at concrete plants after the project start date.

During this monitoring period, from 1 January 2022 to 31 December, 2022, the GHG emission reductions have totaled 21,689 tCO2eq.

Audit Type	Period	Program	VVB Name	Number of years
Validation	(06-November-2018-- 05-November-2025)	VCS Program	Ruby Canyon Environmental, Inc.	7 years
Verification	(01-January-2019--31-December-2021)	VCS Program	Ruby Canyon Environmental, Inc.	3 years

Verification	(01-January-2022—31-December-2022)	VCS Program	Earthood Services Private Limited	1 year

1.2 Sectoral Scope and Project Type

Sectoral Scopes 4 and 6. This is a grouped project.

1.3 Project Proponent

Organization name	CarbonCure Technologies Inc
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1.4 Other Entities Involved in the Project

No other entities were involved in this project.

1.5 Project Start Date

November 6, 2018.

1.6 Project Crediting Period

6 November, 2018 – 5 November 2025; 7-years twice renewal.

1.7 Project Location

Project locations in Colorado, Georgia, Maryland, Kentucky, Ohio, Indiana, Texas, Tennessee, South Carolina, North Carolina, New Mexico, Wyoming, Wisconsin, Iowa. See Appendix I for greater detail.

1.8 Title and Reference of Methodology

VM0043, Methodology for CO_2 Utilization in Concrete Production, V.1.

1.9 Participation under other GHG Programs

This project activity is not part of any other GHG program.

1.10 Other Forms of Credit and Supply Chain (Scope 3) Emissions

This project activity (including all CO_2 supply) is not part of any emissions trading program nor is it obtaining any other form of environmental credit, as proven via attestations that have been provided to the VVB. These include statements from CO_2 suppliers that prove that no regulations or double-counting is occurring. Note that CarbonCure has a publicly available public ledger (https://www.carboncure.com/carbon-credit-registry/) that tracks all credit transactions CarbonCure has delivered via Verra as well as via 'self-certified' credits. 'Self-certified' credits are delivered to credit buyers outside of any GHG programs and/or third-party certification, and are transacted directly between CarbonCure and credit buyers. There is no risk of double counting in these deliveries as they are not for the same locations/geographies and monitoring period, as credits included in this monitoring period. Relevant evidence has been provided to the VVB that includes a list of corporations that have been included in the ledger's transactions that prove that no double-counting has occurred with this monitoring period. The purpose of the public ledger is to ensure that there is transparency around all credit transactions CarbonCure has made to date, to further reduce the risk of double-counting within CarbonCure's supply-chain.

CarbonCure has provided evidence of the relevant public statement made around Scope 3 emissions as published on the CarbonCure website (https://www.carboncure.com/carbon-savings/). See Appendix II.

1.11 Sustainable Development Contributions

This specific project contributes to UN SDG 9 in addition to SDG 13. SDG 9 refers to building "resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". Specifically, we refer to "Goal 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities." This project will produce concrete that both uses CO_2 that would otherwise be emitted to the atmosphere (or is currently in the atmosphere) and requires lower amounts of carbon-intensive Portland Cement. SDG 13 refers to "taking urgent action to combat climate change and its impacts," Specifically Goal "13.2.2" refers to the reduction of total greenhouse gas emissions per year, which is reduced by this project activity.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	9.4	9.4.1Resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.	As a result of this project, new buildings and other infrastructure is using low-carbon concrete, thus helping to make a hard-to-decarbonize industry more sustainable.	During this monitoring period, 2,286,333 million cubic yards of concrete was produced by the project activity, resulting in metric tonnes fewer tons of Portland cement used. This concrete was used in 9,681 buildings and other infrastructure.	The project has contributed in total to 5,886,333 million cubic yards of concrete poured, with 44,804 metric tonnes of fewer Portland cement used in 11,031 buildings and other infrastructure. This considers the impacts of the previous monitoring period.
3)	13.0	13.2.2Tonnes of greenhouse gas emissions avoided or removed	Implemented activities lower cement usage (a carbon-intensive production process) and mineralizes waste CO_2 into concrete.	This project reduced GHG emissions by 21,689 tons.	The project in its entirety has reduced a total of 36,270 tons (there has only been one previous monitoring period that reduced 14,581 tons).

2 SAFEGUARDS

2.1 No Net Harm

There are no negative environmental or socio-economic impacts associated with this grouped project. As the project is taking place at existing concrete manufacturing facilities, no new facilities are being constructed that could potentially have negative environmental impacts. Similarly, as the project takes place at existing concrete manufacturing facilities no negative socio-economic impacts occur.

2.2 Local Stakeholder Consultation

- CarbonCure considers the following entities to be stakeholders in the use of concrete made with CO_2 mineralization: concrete producers, architects, engineers, building owners, contractors, local government officials and regulators.
- CarbonCure regularly engages with all stakeholders to inform them of the benefits of lower carbon concrete and to obtain approval to use CO_2 mineralization in concrete for commercial and public sector projects. This engagement is conducted directly through lunch and learns or similar meetings, and more broadly through sponsorship and participation through industry associations, conferences, and events.
- Feedback from stakeholders is captured through centralized customer resource management tools (e.g. Salesforce), direct feedback collected from CarbonCure-hosted webinars, and through written correspondence from individuals and project teams that have been engaged.
- CarbonCure stakeholders (specifically concrete producers) are in constant communication with their relevant account managers; updates are shared through email and phone calls. Relevant updates are shared with these stakeholders, and they are always able to reach out for relevant questions / requests. Note that relevant webforms are also available for continuous grievances. All contact details including phone number and web-form are noted in this weblink (https://www.carboncure.com/contact-us-2/).
- Additionally, digital logbook communication is constantly open to stakeholders via the myCarbonCure tool built for producers. This tool also includes relevant information to producers around their credit generation process and performance.
- Note that no complaints were received from on-going communication with local stakeholders during this monitoring period.

2.3 AFOLU-Specific Safeguards

This project is a non-AFOLU project and as a result this section is not required.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

There are 151 facilities included in this monitoring period. 43 of which were verified in a previous monitoring report and continue to perform as intended. All facilities have the latest CarbonCure equipment installed, which has a smaller CO_2 injection unit that takes a five-minute resting period between injections. More details of the technology set-up is provided in section 4.2 of the MR. The number of facilities continues to grow year over year for this project. There have been no other changes to the project activity.

3.2 Deviations

3.2.1 Methodology Deviations

1) CarbonCure equipment itself does use electricity, and VM0043 requires direct metering or use of utility bills to quantify the amount of this electricity. However, the actual amounts used are very small and difficult to meter individually. Thus, CarbonCure will provide to the VVB an alternative method. This involves direct metering of a portion of CarbonCure devices and applying a conservative estimate, based on a representative sample of direct measurements, of kWhs used per unit of CO_2 injected into the concrete.

   CarbonCure has undertaken several tests at five separate concrete production facilities. These tests were conducted at facilities in diverse locations, representing different variables that could potentially account for different levels of electricity usage, such as climate.

   Measurements for system energy/power usage breakdown were based on the phases of injection, including idle periods. The calculations show two examples using the peak power consumption to provide a conservative energy usage profile to avoid undercalculating: 1) all days - assuming the system is on 24/7 with no days off and 2) days used - assuming the system only had power the days it was used. The power consumption was calculated during an injection (peak power usage) by measuring the voltage supplied and the current of each enclosure separately. The current measurement was completed with an electrical line splitter to multiply the current value by 10X which was reported and corrected for. The results are provided in the table below:

Max energy usage per day using 117 W measurement during injection										
	Producer 1		Producer 2		Producer 3		Producer 4		Producer 5	
Max Energy usage per day	2.808	kWh	2.808	kWh	2.808	kWh	2.808	kWh	2.808	kWh
Energy per kg CO_2/Day (days used)	0.0711	kWh	0.0302	kWh	0.0954	kWh	0.0276	kWh	0.0817	kWh
Energy per kg CO_2/Day (all days)	0.0995	kWh	0.0432	kWh	0.1316	kWh	0.0350	kWh	0.1221	kWh

   To be conservative, CarbonCure will use the highest of the numbers across all the projects, representing the highest potential level of project emissions associated with electricity usage. The testing above indicates that the highest value is 0.1316 kWhs of electricity per kg of CO_2 injected into the process. CarbonCure believes this is an accurate, and conservative way to estimate electricity usage. CarbonCure does not believe these numbers will change throughout the year based on the type of equipment used. This default will be used for all Q_{elec} calculations used by CarbonCure.

2) As concrete producers can have many different mix designs with the same or similar compressive strength performance, CarbonCure has aggregated mix designs into CarbonCure mix designs based on various industry standard criteria and application. These are outlined in Appendix III of the Project Description. Carboncure mix designs are used in addition to the below deviations.

3) A further deviation has been made to Equation 3 in the VM0043 methodology. As concrete producers can have many different mix designs which are similar in performance, the number of tests required to compare individual baseline and project mix designs to determine the cement cut is not practically feasible given the quantity or necessary given the similarities in mix design performance. As a result, CarbonCure will: a) conduct the testing (in accordance with the testing procedure listed in Appendix II of VM0043) for baseline and project CarbonCure mix designs that comprise 50% or more of the production volume; b) for the CarbonCure mix designs that this testing was conducted for, use the results of the testing data to quantify the cement cut; c) for the CarbonCure mix designs that this testing was not conducted for, CarbonCure will use the average cement cut from (b) (that is, the CarbonCure mix designs that conducted the testing) and apply a 1 standard deviation deduction to ensure conservatism. This approach provides a robust, accurate and conservative approach that is also practically feasible.

4) Similarly, a deviation is applied to the requirement for compressive strength tests. As outlined in VM0043 compressive strength tests are required to assess that the strength of concrete remains the same or greater than the baseline scenario. These tests are performed to provide evidence of strength to producers and concrete producers then go on to sell their concrete commercially. As concrete producers can have many different mix designs which are similar in performance and compressive strength, the number of tests required to compare individual baseline and project mix designs to determine the compressive strength is not practically feasible given the quantity or necessary given the similarities in mix design performance and compressive strength. As a result, CarbonCure will conduct the testing at the producer facility or in a lab (in accordance with the testing procedure listed in Appendix II of VM0043) for baseline and project CarbonCure mix designs that comprise 50% or more of the production volume, ensuring a robust, accurate and conservative approach that is also practically feasible. This data will be provided to the VVB during each verification of the project.

5) Moreover, a slight adjustment to the calculation of the emissions associated with the processing of CO_2 has been made; Equation 12 in the VM0043 methodology. The

injected CO_2 into concrete is used here rather than the value of total CO_2 transported to a facility, as the emission reduction calculation is done on a Ticket level based on each truck load of concrete poured rather than as the total value transported to a facility. This change is made as CarbonCure does not receive any information around the total CO_2 transported to facilities. Evidence can be provided to VVBs that total CO_2 transported is injected into concrete as facilities do not use CO_2 for other purposes.

6) For conservative purposes, CarbonCure treats instances where the CO_2 source of plants has not yet been identified (CO_2 suppliers can keep this information confidential) the same as it would if the CO_2 source were a geological well. In these instances, CarbonCure includes an added_emissions_tonnes value for the portion of the injected CO_2 that is not mineralized. For further details on the inclusion of this calculation please follow notes mentioned in sections 5.1 & 5.2.

3.2.2 Project Description Deviations

Note that EF_{cement} is listed in this monitoring report as monitored parameters rather than default values. The values for each variable change based on each plant, it would be inaccurate to use default values for all the project activity instances. As a result, to ensure accuracy they have been changed to monitored values. This change does not impact additionality, baseline scenario or any associated eligibility criteria's.

3.3 Grouped Projects

An additional 108 facilities have been added to this verification, all facilities are within the United States as per the geographical criteria of the project (per Appendix I). All additional facilities added to this verification meet all the relevant eligibility criteria. Additional details provided below:

VCS Eligibility Criteria	**CarbonCure Compliance with Criteria**
Meet the applicability conditions set out in the methodology applied to the project	1) All new facilities manufacture concrete using CO_2 as a feedstock, as proven by the ownership agreements and ER spreadsheet provided to the VVB 2) All concrete has the same strength performance in the project activity as proven by the ASTM C494 provided to the VVB, as well as relevant strength data provided to the VVB

	3) Attestations were provided to the VVB from new facilities that prove that concrete is sold commercially 4) The ER spreadsheet and supporting documents illustrate that there are instances where SCMs are used in the project for new facilities 5) Attestations were provided to the VVB from new facilities that prove that no recycled concrete is used in the baseline or project scenario 6) All concrete submitted in this monitoring period is from ready-mix concrete, as illustrated by the onsite visit performed by the VVB and the ownership agreements signed with new facilities that were provided to the VVB 7) Attestations were provided to the VVB from new facilities' CO_2 sources that prove the source of CO_2, and locations where the CO_2 came from 8) Attestations were provided to the VVB from new facilities' CO_2 sources that prove they are not part of a cap-and-trade program
Use the technologies or measures specified in the project description	All project activity instances use the technologies and measures specified in the project description as proven by the on site visit completed by the VVB, the proof of technology being used onsite and the ER spreadsheet provided to the VVB
Apply the technologies or measures in the same manner as specific in the project description	All project activity instances apply the technologies and measures specified in the project description as proven by the onsite visits and the ER spreadsheet columns that specify the measures
Are subject to the baseline scenario determined in the	All project activity instances are subject to the baseline scenario determined in the project

project description for the specific project activity and geographic area	description which assumes concrete would have been manufactured through traditional processes
Have characteristics with respect to additionality that are consistent with the initial instances for the specific project activity and geographic area	All project activity instanced are consistent with additionality set out in the project description: regulatory surplus conformance has been proved by sharing fiscalnote with the VVB, and the positive list requirement is applicable as the project activity instance meets all the eligibility criteria in VM0043
Occur with one of the designated geographic areas specified in the project description	All project activity instances are in the United States of America as has been proved by their relevant project location and geodetic coordinates in Appendix I of this document
Conform with at least one complete set of eligibility criteria of new project activity instances	All project activity instance conforms with all eligibility criteria's as expressed in this table
Included in the monitoring report with sufficient technical, financial, geographic, and other relevant information to demonstrate conformance with the applicable set of eligibility criteria and enable evidence gathering by the VVB	All project activity instances have sufficient technical, financial, geographic and other relevant information as has been provided to the VVB during the verification, evidence includes ownership agreements, data-rich corporation and facility emission reduction data and calibration reports
Be included in an updated project description, with updated project location information	All additional project activity instances have been included in the project description in Appendix II
Have evidence of project ownership, in respect of each project activity instance	All additional project activity instances have ownership agreements that are signed with CarbonCure, these have been provided to the VVB during verification
Have a start date that is the same as or later than the grouped project start date	All project activity instances in this monitoring period are for Jan 1-2022 which is after the grouped project start date of Nov 6-2018

Be eligible for crediting from the start date of the project activity instance through to the end of the project crediting period	All additional project activity instances are eligible from the start date to the end of the project credit period, as they will be pouring concrete for that entire time
Only eligible for crediting from the start of the verification period in which they were added to the grouped project	All additional project activity instances in this monitoring period are from the period Jan 1-2022 to Dec 31-2022 and are eligible for crediting from the verification period
Not be or have been enrolled in another VCS project	No existing or incremental project activities have been included in any other VCS project – as evidenced by geodetic coordinate comparisons
Adhere to the clustering and capacity limit requirements for multiple project activity instances	Note that this project has no capacity limits per VM0043. Note that this project complies with the cluster limits as any additional project activity instances that are within 10km of one another have been added to this project

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	Default efficiency of mineralization
Data unit	Ratio
Description	Amount of CO_2 injected in the concrete manufacturing process that gets mineralized into the concrete.
Source of data	See Appendix VI in VM0043
Value applied	0.60
Justification of choice of data or description of measurement methods and procedures applied	See Appendix VI in VM0043
Purpose of Data	This is the default value that is applied to the baseline emission calculation. It determines captured CO_2 option 2, as noted in equation 5a in VM0043

Comments	This parameter indicates the *efficiency of mineralization*. There have been tests done on this efficiency as outlined in Appendix VI of VM0043. These tests show quite a range of results in terms of the efficiency of the uptake of CO_2 into the concrete, and there appears to be little correlation between the efficiency of mineralization and the percent dosing of CO_2. However, the lowest test result is at 76%, meaning that three-quarters of the CO_2 that is injected into the process gets mineralized into the concrete. At a conservative default, the assumed efficiency of mineralization will be set at 60%

Data / Parameter	Default factor for amount of energy required to capture, treat, and compress a tonne of CO_2
Data unit	kWh/tonne
Description	Default factor for amount of energy required to capture, treat, and compress a tonne of CO_2
Source of data	See Appendix V of VM0043
Value applied	200 kWh/tonne of CO_2 processed
Justification of choice of data or description of measurement methods and procedures applied	See Appendix V of VM0043
Purpose of Data	Default applied to project emissions calculations to determine capture, compression, and transport of CO_2 value option 2, as noted in equation 11a of VM0043
Comments	N/A

Data / Parameter	EFCO2,i
Data unit	Tonne of CO2 per tonne-mile
Description	Emission factor for mode of transport
Source of data	See table in Section 8 from EPA Center for Corporate Climate Leadership
Description of measurement methods and procedures to	This is an accurate and simplified default for considering the emission factors of different modes of transport, the US EPA tracks, monitors, and updates these values

be applied	
Frequency of monitoring/recording	Annual
Value monitored	The most up to date value the EPA has provided is 0.000233 tCO2e/tonne-mile
Monitoring equipment	NA
QA/QC procedures to be applied	NA
Purpose of Data	Value applied to project emissions calculations to determine capture, compression and transport of CO_2 value (Option 2), as noted in equation (11a) of VM0043
Calculation method	NA
Comments	NA

4.2 Data and Parameters Monitored

Data / Parameter	$Q_{cement,i,p,y}$
Data unit	Tonne
Description	Quantity of Portland cement used in the project for concrete produced using a project mix design i in year y
Source of data	CarbonCure and Individual Concrete Producer
Description of measurement methods and procedures to be applied	Use standard weighing procedures to determine mass of cement used to produce concrete over the course of year Y
Frequency of monitoring/recording	Measured continuously
Value monitored	The values applied will vary based on each CarbonCure mix design for a given facility. As this is a grouped facility with multiple facilities and hundreds of mix designs this data is provided directly to the VVB and Verra in the ER spreadsheet in Column O.
Monitoring equipment	Scales
QA/QC procedures to be applied	Note that frequency of calibration is based on DOT laws that are regionally determined. As this is a grouped project various calibration frequency will be applied to different facilities based on their location. The GDOT requires calibration to

	occur every 6-months for most of these facilities, relevant samples have been provided to the VVB for verification these were for serial number 6967, 183363, 176640, 40364, CB263564, CB236487, CBH236403, SBH236274. A sample of the calibrations is provided in Appendix IV of this document.
Purpose of the data	1. Values are applied to baseline emissions calculation to determine $Q_{cement,i,b,y}$ in equation 3 2. Value is also used in the project emission calculation, equation 7
Calculation method	NA
Comments	NA

Data / Parameter	$Q_{Cement,b,i,test\ n}$
Data unit	Tonne
Description	Quantity of Portland cement used to prepare baseline compressive strength test specimen *n* for concrete produced using a mix design that results in a concrete of equivalent compressive strength to project mix design *i*
Source of data	CarbonCure and Individual Concrete Producer
Description of measurement methods and procedures to be applied	See Appendix II of VM0043
Frequency of monitoring/recording	Once per project crediting period for the Corporation's (or Division's) CarbonCure mix designs that comprise 50% or more of production volume
Value monitored	The values applied will vary based on each CarbonCure mix design for a given facility. As this is a grouped facility with multiple facilities and hundreds of mix designs this data is provided directly to the VVB.
Monitoring equipment	Scales
QA/QC procedures to be applied	See Appendix II of VM0043
Purpose of the data	Calculation of baseline emissions by comparing the amount of cement in the project activity concrete and the amount of

	cement that would be required in the baseline concrete as noted in equation 3 of VM0043
Calculation method	NA
Comments	NA

Data / Parameter	$Q_{Cement,p,i,test\ n}$
Data unit	Tonne
Description	Quantity of Portland cement used to prepare project compressive strength test specimen *n* for concrete produced using a mix design that results in a concrete of equivalent compressive strength to project mix design *i*
Source of data	CarbonCure and Individual Concrete Producer
Description of measurement methods and procedures to be applied	See Appendix II of VM0043
Frequency of monitoring/recording	Once per project crediting period for the Corporation's (or Division's) CarbonCure mix designs that comprise 50% or more of production volume
Value monitored	The values applied will vary based on each CarbonCure mix design for a given facility. As this is a grouped facility with multiple facilities and hundreds of mix designs this data is provided directly to the VVB .
Monitoring equipment	Scales
QA/QC procedures to be applied	See Appendix II of VM0043
Purpose of the data	Calculation of baseline emissions by comparing the amount of cement in the project activity concrete and the amount of cement that would be required in the baseline concrete as noted in equation 3 of VM0043
Calculation method	NA
Comments	NA

Data / Parameter	EFcement
Data unit	tCO2e/t of cement

Description	Emission factor for the Portland cement used in the baseline and in the project
Source of data	Relevant EPDs or EPD national averages for a given facility
Description of measurement methods and procedures to be applied	EPDs are comprehensive summary reports of environmental impact of material's production based on the entire life cycle assessment (LCA) that is then verified by a third party. As multiple values are used, all with various providers, measurement methods will vary. Note that as there are multiple EPDs used for this monitoring period, all EPDs have been provided to the VVB for review to verify the various measurement methods and procedures that are applied.
Frequency of monitoring/recording	A given EPD for a cement type will be re-done every 5 years
Value monitored	The values applied to this monitoring period are 658.24, 728.64, 759.44, 764.72, 782.32, 793.76, 797.104, 811.36, 871.2, 924, 961.84, 1,174.48 all values recorded are kg of CO_2 equivalent per tonne of cement. These values are the EPD values following the application of the 12% discount specified in VM0043
Monitoring equipment	A program operator reviews all EPDs to ensure accuracy
QA/QC procedures to be applied	NA
Purpose of the data	Value applied to baseline and project emissions calculations to determine emissions from the production of Portland cement in the baseline equation 2 and in the project equation 7
Calculation method	A 12% discount figure is applied to all EPD values, as this entire project crediting period uses option 2 as applied to equation 2 in VM0043. Note there is one instance in this monitoring period that a facility used the same cement type but from two different sources, in this instance a weighted average of the use of both EPD values was used to calculate the EPD value
Comments	NA

Data / Parameter	$Q_{CO2,meter,y}$
Data unit	Tonne
Description	Amount of CO_2 injected in year *y* to produce concrete, as determined by a flow meter

Source of data	CarbonCure
Description of measurement methods and procedures to be applied	The use of calibrated flow meters. Calibration must be conducted according to the equipment manufacturer's specifications. The amount of CO_2 must be metered before entering the production process and must be subject to standard calibration and QA/QC procedures for the measurement of critical data variables. Note that a sample of a flow meter calibration is provided in Appendix III of this document.
Frequency of monitoring/recording	Data must be monitored continuously and recorded on at least a daily basis
Value monitored	The total value monitored for this entire monitoring period is 825.6110124 tonnes
Monitoring equipment	Flow meter
QA/QC procedures to be applied	The use of calibrated flow meters. Calibration is conducted according to the equipment manufacturer's specifications (FUTEK), once a year, all calibration has to be within +/-3%. The amount of CO_2 must be metered before entering the production process and must be subject to standard calibration and QA/QC procedures for the measurement of critical data variables, note calibrations occur before the CO_2 equipment is shipped out to the facilities
Purpose of the data	1. Calculation of baseline emissions when measuring how much CO_2 was injected into the concrete as noted in equation 5a in VM0043. 2. Calculation for project emissions calculation for processing CO_2 as noted in option 2, equation 11a in VM0043 3. As noted in deviation 5 of section 3.2.1 this value also replaces $Q_{CO2,supplied,y,I}$ in the project emissions calculation that determines the project emissions associated with the transportation of CO_2 of equation 12 in VM0043 4. Added back into value for added emissions deviation where CO_2 source is unknown
Calculation method	N/A

Comments	Project proponents may use a mass-flow meter to measure mass of CO_2. The meter is embedded into the CarbonCure equipment

Data / Parameter	$Q_{elec,y}$
Data unit	MWh
Description	Quantity of incremental, additional electricity from the grid in year y used to power the equipment needed to operate the project activity in year y (MWh)
Source of data	CarbonCure and the Individual Concrete Producer
Description of measurement methods and procedures to be applied	See deviation 1 in section 3.2.1
Frequency of monitoring/recording	See deviation 1 in section 3.2.1
Value monitored	The total value for this monitoring period is 108.6504092 MWh as indicated in Column S in the ER spreadsheet
Monitoring equipment	Electricity meter default value and flow meter value
QA/QC procedures to be applied	Not applicable as a conservative default value is used for all instances
Purpose of the data	Project emission calculation for the quantity of electricity used by the CO_2 injection equipment as bite dub equation 8 of VM0043
Calculation method	The default value noted in deviation 5 in section 3.2.1 (0.1316 MWh/tonne) termed 'elec_usage' is multiplied by the QCO_2,meter,y value
Comments	NA

Data / Parameter	EF_{elec}
Data unit	tCO2e/MWH
Description	Emission intensity of electricity used to transport CO_2 and at the project facility.
Source of data	US EPA eGrid
Description of measurement methods	eGrid emissions factor published by the US Envirionmental Protection Agency for the US, values are region and year

and procedures to be applied	specific. Note that values can differentiate for the same ticket as the region of a concrete production facility and a CO_2 processing facility are not always the same
Frequency of monitoring/recording	Annual
Value monitored	The values used for producer facilities are noted below: 0.2915, 0.3706, 0.3733, 0.466, 0.4252, 0.4549, 0.4774, 0.5289, 0.7222 all values are recorded in tCO2e/MWh The values used for CO_2 processing value are noted below 0.3706, 0.4252, 0.4549, 0.4703, 0.4774, 0.5289, 0.7052, 0.7222 all values are recorded in tCO2e/MWh Note that all the above values are regionally based (as they are all for the same year) and will depend on which areas the facilities are based on
Monitoring equipment	NA
QA/QC procedures to be applied	NA
Purpose of the data	1. Project emissions calculation for the emissions intensity of electricity for the CO_2 injection equipment calculation as in equation 8 in VM0043 2. Project emissions calculation for the emissions intensity of electricity for CO_2 processing as noted in option 2 equation 11a in VM0043, this value is further distinguished in the ER spreadsheet and termed 'ef_elec_processing'
Calculation method	NA
Comments	NA

Data / Parameter	Miles transported in year y by mode i
Data unit	Miles
Description	Miles of shipped CO_2 to the project site by mode i
Source of data	CO_2 supplier, transporter and CarbonCure
Description of measurement methods and procedures to be applied	The CO_2 supplier provides CarbonCure with the addresses of the source and depot of CO_2, CarbonCure has the addresses of all the plant facilities that CO_2 is transported to

Frequency of monitoring/recording	Annual
Value monitored	The values applied will vary for each facility, as this is a grouped project there is a large number of facilities and as a result values are provided to the VVB for each given verification in the ER spreadsheet in Columns Y and Z.
Monitoring equipment	Geospatial database or alternatively measuring tool in google maps
QA/QC procedures to be applied	Records from CO2 supplier or transporter available at project verification.
Purpose of Data	Value applied to project emissions calculations to determine capture, compression and transport of CO2 value (Option 2), as noted in equation (11a) of VM0043
Calculation method	The addresses of CO_2 source, depot and plant where CO_2 is transported to are saved as coordinates in the CarbonCure database and a distance calculation is made using geospatial database. A 1.5 multiplier is made to for each distance (to account for the fact that it's not a straight line), and then this value is doubled to account for the drive there and back. Unfortunately as paths are not consistently driven, this approach is used to account for all various routes that could be driven
Comments	NA

4.3 Monitoring Plan

The Monitoring Plan will comprise of the following elements:

1. Cement values: producers will be able to determine the cement content in the project activity concrete, by weighing cement values in each batch of concrete. Most producers have a well-established way to precisely measure the cement content of their concrete. However, an important component of this part of the monitoring plan is establishing the baseline cement value. To do this, CarbonCure and the producers will do the following:
    a. Define CarbonCure Mix Designs: For each producer, CarbonCure will provide, in a database made available to the VVB, a listing of each CarbonCure Mix Design that the producer's facilities will produce. CarbonCure will indicate which CarbonCure Mix Design was used, based on its criteria (design strength (psi), cement type (e.g., type I/II), % SCMs, blend of aggregates (e.g. coarse+fine), strength enhancing admixtures (e.g. Xseed)) - and provide a specific identification number for that CarbonCure Mix Design. The defined CarbonCure Mix Designs can be found in the Appendix III in the Project Description.
    b. VM0043 requires that the baseline and project samples have an equivalent level of compressive strength, and CarbonCure and the individual producer will conduct these tests for at least three baseline and three project samples for the CarbonCure Mix

Designs that comprise 50% or more of production. The process for conducting these tests is provided in Appendix III in the Project Description. These tests will take place across the producer's plants (unless the same mix is used across multiple sites, in which case the testing procedure has to be done only once), and the results for each CarbonCure Mix Design will be sent to CarbonCure and archived in a central database that will be made available to the VVB. CarbonCure Mix designs can yield slightly different compressive strength results based on test results. As a result, if multiple tests are conducted on the same CarbonCure Mix Design then an average of all tests is taken to determine the cement reduction of the CarbonCure Mix design. As concrete producers can have many different mix designs which are similar in performance, mix designs will be aggregated into CarbonCure Mix Designs based on their criteria (design strength (psi), cement type (e.g., type I/II), % SCMs, blend of aggregates (e.g. coarse+fine), strength enhancing admixtures (e.g. Xseed)), resulting in multiple mix designs leveraging the same compressive strength testing. To ensure an approach that is robust, accurate and conservative but also practically feasible, CarbonCure will conduct this testing for the CarbonCure Mix Designs that comprise 50% or more of production. The VVB will also be allowed to visit any of the project sites and review any of the tests: testing procedures and the personnel who conducted them. This testing data will be archived for a period of two years after each monitoring report.

c. For each CarbonCure Mix Design, CarbonCure and the producer will develop a baseline mix – an equivalent concrete product that would be used for the same application, but which would not have included any of the technologies or materials from the project activity. In other words, the reference concrete product is what would have been produced in the baseline scenario, using previous levels of cement. These reference amounts will contain the baseline levels of cement which are integral to determining the cement cuts. To determine the value of cement cuts, the difference between the baseline and project scenarios is used. CarbonCure will arrive at these amounts by one of two ways: 1) for the CarbonCure Mix Designs that this testing noted above was conducted for, use the results of the testing data to quantify the cement cut; or 2) for the CarbonCure Mix Designs that this testing was not conducted for, CarbonCure will use the average cement cut from (1) but apply a 1 standard deviation deduction to ensure conservatism.

2. Quantity of CO_2 used:

   a. CO_2 injection will be used to further reduce the amount of cement content required. This element of the Monitoring Plan will require CarbonCure to measure, through a flow meter, the amount of CO_2 that is injected into the concrete manufacturing process. This will happen at each site. The data will be exported by each site daily into a centralized data management that will be maintained by CarbonCure at its headquarters.

   b. Calibration for the equipment that measures the amount of CO_2 injected into the concrete mix will occur during the project. Each CarbonCure system is calibrated by comparing the metered CO_2 via a flow model versus the weight change from a CO_2 tank that is on four load cells in the CarbonCure manufacturing facility. The data from the calibration is aggregated to confirm that the flow model is +/-3% of what the load cells have sensed. Calibration is completed once before the equipment is deployed to facilities. Additional calibration can be done based on the performance of the equipment.

3. Quantity of cement actually used: In its normal course of business, every concrete producer tracks – at every one of its facilities – both the cement content of its concrete and everything else – water, aggregates, etc., which go into every truck before it goes to a job site. Each component of the concrete is weighed separately before it is mixed. All of this weight data is archived, so the producer will know how much cement went into each unit of concrete that is sent to each customer location. The demonstration of this data management system will be provided upon project validation, and a verifier will be able to randomly spot check individual records (eg: quantity of cement mixed with Concrete Project Design X on Day Y, which went in a truck to Job Site Z).
4. All other calculations: CarbonCure's software team has developed checks within the system to continuously update for latest EPA values.

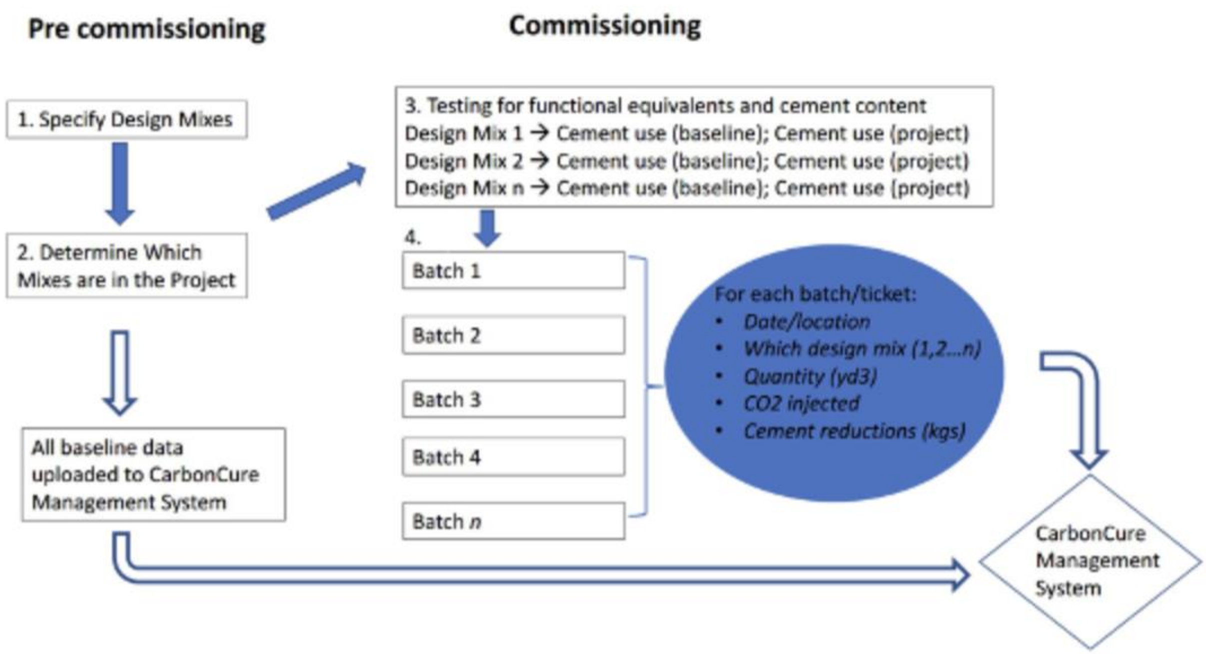
In instances of non-conformity, the below actions will be taken to ensure that the data is monitored and calculated accurately:

- Points of Vulnerability and QA/QC: Most of the data required for this project are handled as a matter of course for concrete producers and CarbonCure, such as concrete quantities and cement purchases – essentially normal supply chain management and product sales. The potential weak points relate to transferring that data from each of the facilities to a centralized database that will be reviewed by a VVB. Again, the key data includes:
    a. List of CarbonCure Mix Designs and justification for specifying a specific mix design within the CarbonCure Mix Design
    b. Developing a reference baseline sample and measuring the compressive strength of that sample and the project sample for the CarbonCure Mix Designs that comprise 50% or more of production
    c. Concrete produced, delineated by CarbonCure Mix Design
    d. Cement quantities in the project activity
    e. CO_2 usage, transport, and electricity consumption of the CO_2 injection equipment

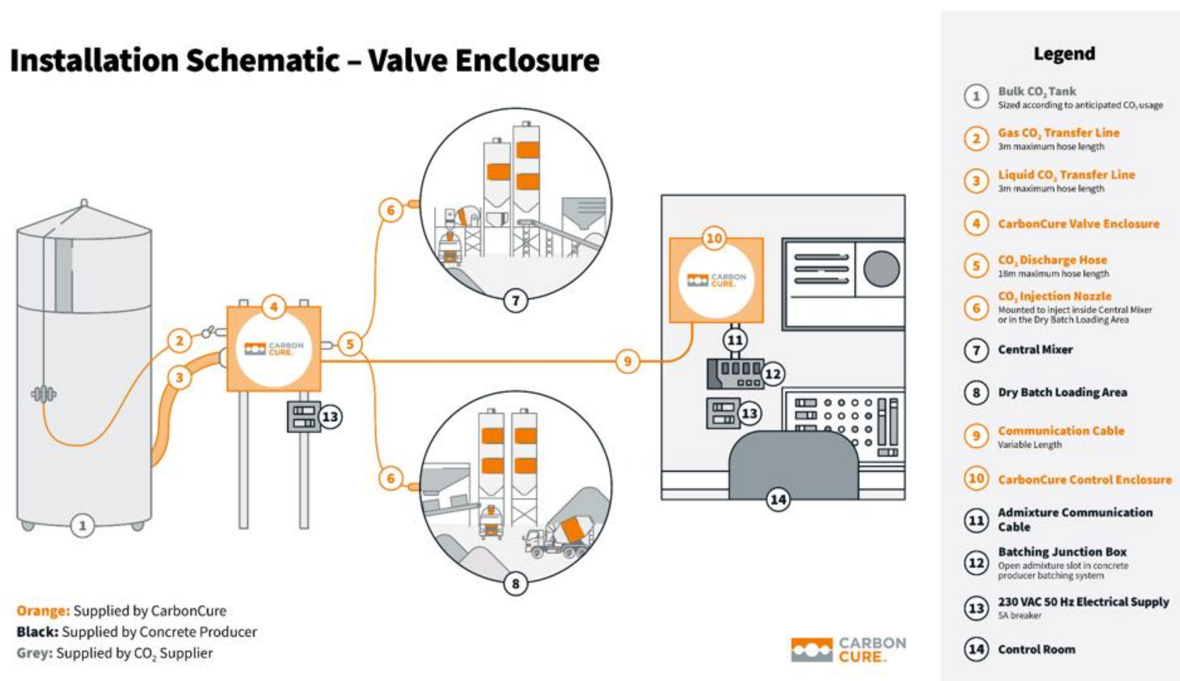
These are not many data variables but if they occur across many facilities and multiple mix designs, there is potential for human error. The following QA/QC procedures will be put in place:

- CarbonCure has built in quality assurance into their Technical Services team that uses standard operating procedures to capture baseline data. A data management system will be established to transfer data for all key parameters to the overall project manager at CarbonCure for this activity. Frequent double checking of the data that gets exported to the central management system will take place, as will a system to automatically flag anomalies if, for example, there are unexplained data swings – outside of established parameters – that would indicate an error.

- Cross-checks will take place, such as what the central database, and rectified where appropriate.
- The central CarbonCure team will also make sure that key records related to the measurement equipment itself are archived and available, particularly calibration reports for meters and other key measurement devices. All calibration will take place in accordance with the recommendations of the measurement device manufacturer. A list of measurement devices at each site will be provided to the VVB upon project validation.
- CarbonCure has a system in place already with its producers to collect this data through a web portal, which is uploaded to a centralized data management system operated at CarbonCure's headquarters.
- When a new facility installs CarbonCure equipment today, the site goes through a pre- commissioning phase, where baseline mix designs are identified and cataloged with the amount of cement, SCMs, etc. included in the design. From there, CarbonCure determines the materiality of each mix design. CarbonCure plans to just focus on the mix designs that make up the majority of the facility's production will be part of the offset project as some mix designs may simply be too small a percentage of a site's production to be worth all the testing. Based on the producer's actual production, CarbonCure may revisit a site after the pre-commissioning phase to complete additional strength testing.
- In the commissioning phase, CarbonCure runs trials on these primary mix designs to determine the maximum amount of cement reduction that can take place. After full installation, CarbonCure is then able to track each batch that is produced and goes into a truck on its way to the construction site. This batch data, including the date and location of where the concrete went, is uploaded to the CarbonCure management system. The vast majority of concrete producers have this entire process – from mixing the ingredients to weighing the concrete prior to going into the truck to tracking to the final destination – automated, and thus CSV data can automatically be sent to CarbonCure, without any real human intervention. CarbonCure can track each batch, what mix design it is, what amount of cement is in that batch, etc.



Note CarbonCure has also provided a diagram of the installation schematic below for better visualization of the systems in place onsite at facilities.



Organization: Various teams at CarbonCure are dedicated to the data collection, processing and storage of credit data. These teams have various levels of expertise in their field, and work in parallel with one another.

- The Technical Services team at CarbonCure work closely with concrete producers to perform relevant QA/QC tests as well as supporting producers to collect various. This is a trained and skilled team of engineers that are highly familiar with the concrete industry. Note that there are instances where concrete producer's internal quality control team or third-party testing agencies will perform compressive strength tests. ACI/ASTM standards require by law that any personnel completing testing has the relevant engineering and testing qualifications.

- The Software Engineering team works to process the credit data based on the VM0043 methodologies calculation and stores it accordingly. This team follows a typical structure of a Software company, all with high fluency in data engineering and management.
- The Research team performs all relevant calibration monitoring and reporting. This is a team of Engineers that have numerous years of experience in the concrete innovation sphere.
- The Carbon Finance team will be responsible for leading the monitoring period with various groups within the CarbonCure team. This team has experience in the carbon credit space and the nuances of monitoring, reporting and validation.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Emissions in the baseline scenario are associated with two components, as noted below. Note that as the concrete industry deals with truckloads of concrete, all calculations are completed on a ticket level (truckload of concrete) and then aggregated for the relevant year.

1. **BEy = BEACU,y + BECO2,cap,y**

BEy = Baseline emissions in a given year (y) (tCO2)

BEACU,y = Emissions from the production of Portland cement that would have been used in the absence of the project activity (avoided cement usage) (tCO2e) in year y

BECO2,cap,y = Emissions from the capture of CO2 (tCO2e) in year y

BEy is captured in Column AO of the spreadsheet, which adds Column AI and AJ together. For the relevant year aggregate, the entire column can be summed as this monitoring period is only assessing 2022. Further explanation of the breakdown of calculations are noted below.

Component 1: Avoided Cement Emissions (BEACU)

The first component of the baseline emissions calculation is the displacement of conventional cement production (without the injection of CO_2). Note that Option 2 is used for the EFcement value per VM0043.

1A. $BEACU_{,y} = \sum_i [Q_{cement,i,b,y} \times EF_{cement}]$

Where:

$BEACU_{,y}$ = Emissions from the production of Portland cement that would have been used in the absence of the project (tCO_2e) in year y

$Q_{cement,i,b,y}$ = Quantity of Portland cement that would have been used in the baseline for concrete produced using a project mix design *i* in year y (metric tonnes).

EF_{cement} = Emissions factor of Portland cement production (tCO_2e/metric tonne of cement)

BEACU,y is calculated in Column AI and multiplies Qcement,i,b,y (Column P) and EFcement (Column N) appropriately.

The components for the Quantity of Portland cement that would have been used in the baseline for concrete are calculated as below:

1Ai. $Q_{cement,i,b,y} = \sum_I [Q_{cement,I,p,y} \div (\sum_n Q_{cement,p,i,test,n} \div \sum_n Q_{cement,b,i,test,n})]$

Where:

$Q_{cement,i,p,y}$ = Quantity of Portland cement used in the project scenario for concrete produced using a project mix design *i* in year y (metric tonnes).

$Q_{Cement,p,i,test\ n}$ = Quantity of Portland cement used (e.g., metric tonnes) to prepare project compressive strength test specimen *n* for concrete produced using project mix design *i.* The testing process is outlined in Appendix II of the project description.

$Q_{Cement,b,i,test\ n}$ = Quantity of Portland cement used (e.g., metric tonnes) to prepare baseline compressive strength test specimen *n* for concrete produced using a baseline mix design, that results in a concrete of equivalent compressive strength to project mix design *i.* The testing process is outlined in Appendix II of the project description.

The calculation for Qcement,i,b,y (Column P) is detailed in the ER spreadsheet. As all calculations are made on a ticket level (per batch of concrete that is poured) and this monitoring period has hundreds of thousands of individual tickets the ER spreadsheet is simplified to show a cement_cut_pct value in column E. The value noted here is based on the compressive strength data available for CarbonCure mix designs that constitute 50% of producer volume, and where relevant the producer average (minus a standard deviation) is used. (Column F) 'Is_cct_mixdesign_cement_cut' applies the relevant CCT mix design cement cut if the value is 'T,' if the value shows 'F' then the relevant corporation average is applied to that ticket. Source data for the cement cut values used in the ER spreadsheet based on compressive strength tested is provided separately to the VVB.

Note that the formula in Column P simplifies the percentage and then divides $Q_{cement,l,p,y}$ (Column O) with it appropriately. The values for the project scenario cement weight are derived from batch actual ticket data that is measured as each truckload of concrete is poured, relevant source data will be provided to the VVB for these values.

1Aii. EFcement – this value is based on Option 2 of VM0043.

The EFcement value is derived from the relevant cement EPDs or national average EPDs for a given corporation. These are noted in the ER spreadsheet in Column L. Column M shows the 12% discount that's noted in VM0043, Column N simply applies the 12% discount to the EPD value. Relevant source data for these values will be provided to the VVB.

Component 2: Captured CO_2 ($BE_{CO2,cap}$):

Option 2 is used to determine the amount of CO_2 captured and mineralized in concrete. This option uses a default mineralization efficiency of 60% as defined in VM0043.

1B. $BE_{CO2,cap,y} = Q_{CO2,meter,y} * DEF$

Where

$Q_{CO2,meter,y}$ = Amount of CO_2 introduced in year y into the concrete production process, as determined by a flow meter (tCO_2) at the project activity location.

DEF = Conservative default for the quantity of CO_2 that is mineralized into the concrete product/material. This value is 0.6 for ready-mix concrete.

Column Q in the ER spreadsheet notes the values for $Q_{CO2,meter,y}$ that comes in through the telemetry technology CarbonCure has onsite at producer facilities. Column AJ in the ER spreadsheet multiplies this column with Column AC which has the 0.6 mineralization efficiency value.

5.2 Project Emissions

Project emissions include any additional electricity or fossil fuels used at the concrete manufacturing facility used by the CO_2 injection equipment, as well as the emissions from the processing and transport of the CO_2. Project emissions in year y of the project crediting period will be expressed as below, note that the calculation first occurs on the Ticket level and is then aggregated for a given year:

2. $PE_y = PE_{cement,y} + PE_{elec,y} + PE_{ffc,y} + PE_{CO2,y} + PE_{added\_emissions\_tonnes}$

Where

PE_y = Project emissions in year y (tCO2e)

$PE_{cement,y}$ = Emissions from the production of cement used at the project facility in year y (tCO2e)

$PE_{elec,y}$ = Emissions from the incremental use of electricity by the CO_2 injection equipment at the project facility in year y (tCO_2e)

$PE_{ffc,y}$ = Emissions from the incremental combustion of fossil fuels by the CO_2 injection equipment at the project facility in year y (tCO_2e)

$PE_{CO2,y}$ = Emissions associated with the capture, compression and transport of CO_2 to the location where it will be sequestered in concrete in year y (tCO2e).

PE added_emissions_tonnes = Emissions associated with CO_2 source *where it is not known*, this applies the entire portion of q_CO_2_meter at the project facility for the relevant facilities where CO_2 is not known

PEy value is captured in Column AP of the ER spreadsheet. This column adds values from Columns AK, AL, AM, AN and AF each representing the components that calculate project emissions. Further details noted below for the calculation of each component.

<u>2A. $PE_{cement,y} = \sum_i Q_{cement,i,p,y} \times EF_{cement}$</u>

Where:

$PE_{cement,y}$ = Emissions from the amount of cement used at the project facility in year y (tCO2e)

$Q_{cement,i,p,y}$ = Quantity of Portland cement used in the project for concrete produced using a project mix design *i* in year y (metric tonnes)

EF_{cement} = Emissions for the Portland cement used in the project (tCO2eq/metric tonne of). The same option as described in Section 4.1 will be used.

PEcememt.y is captured in column AK of the ER spreadsheet. Similarly, to the baseline calculation this value uses relevant cement EPDs or national average EPDs and applies a 12% discount as captured in Columns L-N. The project emissions value is captured from batch actual data from the concrete producer in Column O.

<u>2B. $PE_{elec,y} = Q_{elec,y} \times EF_{elec}$</u>

Where:

$PE_{elec,y}$ = Emissions from the use of electricity at the project facility in year y (tCO_2)

$Q_{elec,y}$ = Quantity of electricity used by the CO_2 equipment from the grid in year y used to power the equipment needed to operate the project activity in year y (MWH)

EFelec = Emissions intensity of the electricity (tCO2/MWH)

PEelec,y is calculated in Column AL: multiplying Qelec (Column S) and EFelec (Column T). Qelec,y uses deviation 1 in Section 3.2.1 that applies a 0.1316 default (Column R) and multiplies that accordingly with metered quantities of CO_2 (Column Q). The EFelec value is based on EPA values based on each facilities' sub-region. The values used in this monitoring period are provided in section 4.2.

2C. PEffc,y – for this project CarbonCure will not be using any additional fossil fuels and as a result Column AM is 0. All the values for this equation are noted in the ER spreadsheet by Columns V, W and X and are noted as 0.

2D. $PE_{CO2,y} = PE_{CO2,processing,y} + PE_{CO2,transport,y}$

Where:

$PE_{CO2,y}$ = Emissions associated with the capture, compression and transport of CO_2 to the location where it will be sequestered in concrete in year y (tCO_2e)

$PE_{CO2,processing,y}$ = Emissions associated with the capture, compression and processing of CO_2 in year (tCO_2e)

$PE_{CO2,transport,y}$ = Project emissions associated with the transport of CO_2 to the project site in year y (tCO_2e)

$PECO_2$ is represented by Column AN in the ER spreadsheet this combines Column AG and Column AH. Breakdown of how each component is calculated is noted before.

2Di. PECO2,processing,t = QCO_2,meter,t X 200 kWh/tonne X EFelec

Where:

QCO_2,meter,y = Amount of CO_2 injected in ticket t and aggregated for that year into the concrete production process, as determined by a flow meter (tCO_2) at the project activity location

EFelec = Emissions intensity of the electricity (tCO_2/MWh)

Option 2 of VM0043 is used to calculate CO_2 processing values, here a 200 kWh/tonne default is used as represented in Column AD. The value for metered CO_2 in column Column Q is used as a component of PECO2processing. As CO_2 plants/depots can have different EFelec values to producer facilities a new column EF_elec_processing in Column U is used to derive the EPA values for the relevant CO_2 processing sub-regions.

2Dii. $PECO_2$,transport,y = ∑i (QCO_2,injected,y,i x miles transported,I x EF CO_2 i)

Where:

$PECO_2$,transport,y = Project emissions associated with the transport of CO_2 per ticket in year y (tCO_2e).

$QCO_{2,meter,y,i}$ = Amount of CO_2 procured from a source in year y and injected into concrete by mode i. (tCO_2)

$EF\ CO_{2,i}$ = CO_2 emission factor for mode i (barge, rail, or truck), (tonne/tonne-mile).

PECO2,transport,y is captured in Column AH, this value uses (per deviation 5 in section 3.2.1) the amount of injected CO_2 on a ticket level (Column Q). There is a breakdown of the distances travelled from where CO_2 source is captured and the depot where CO_2 is stored to the plant. This distinction is denoted by Column Y and Z: these take the geodetic coordinates of these addresses and add a factor of 1.5 and then double it. As there might be instances where the mode of transport is different between each location two columns AA and AB are used to denote transport modes from each location. For this monitoring period trucks were used to transport all CO_2 sources from all locations. As a result, per the latest values from the US EPA for truck emission usage a value of 0.000023 is used here. Addresses for all locations from the CO_2 suppliers will be provided to the VVB during verification.

2E. Added emissions – this value is denoted by Column AF in the ER spreadsheet, per deviation 6 in section 3.2.1 this is included to take into account instances where CO_2 sources are unknown. Where Column AE shows a 'True' value the QCO2 meter value is added to this column and the injection of CO_2 is added as a project emission for the relevant ticket.

5.3 Leakage

No sources of leakage have been identified for this project activity per VM0043.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
01-01-2022 to 31-12-2022 (2022)	451,779	430,090	0	21,689
Total	451,779	430,090	0	21,689

Ex-ante emissions	Achieved emissions	Percent difference	Justification for the difference

reductions /removals	reductions /removals		
30,000	21,689	-32.15777%	CarbonCure has opted to separate it's United States producers into two different project descriptions, meaning there are less facilites in this MR than had been initially intended

APPENDIX I: LOCATION OF FACILITIES

corporation_id	plant_id	address	latitude	longtiude
462	1305	8092 Hillmark Ct.	39.3932593	-77.3865001
604	3962	295 Quarry Road	37.4719359	-86.324009
604	4887	600 Ausperger Rd.	39.4345434	-84.5334009
604	5409	6601 Ringwood Rd	39.5293987	-84.7781923
604	15194	152 Cherry Street	38.00049	-84.17745
604	15199	1261 East Main Ext.	38.2037278	-84.527778
604	15200	7352 South 900 East	40.49875	-87.1508
604	15207	12901 Avoca Rd.	38.2620877	-85.5080616
604	15214	515 Downs Blvd	35.9065147	-86.88712129
604	15220	1310 West Maumee Street	41.63613	-85.01628
604	15225	9350 East 30th Street	39.813757	-86.001251
604	15241	6300 Ardmore Ave	41.0233137	-85.1924433
604	15244	15215 River Road	40.0085281	-86.032859
604	15250	2605 Kentucky Ave.	39.7273276	-86.2063292
604	15251	360 S County Road 200 E	39.7537563	-86.4865173
604	15254	306 N. Murphy Ave.	39.5325119	-87.10810389
604	15256	2196 Barren River Rd, Ste 100	37.01419	-86.4775
604	15257	4708 Industrial Road	41.121246	-85.147544
604	15261	6616 Robertson Avenue	36.16223	-86.88516
604	15267	5223 East Margaret Drive	39.4347424	-87.3378951
604	15272	2903 IN-25	40.457018	-86.83936
604	15276	911 US Hwy 50	39.16002	-84.25776
604	15283	14413 U.S. 40	39.81037	-85.14987
604	15293	13415 Coldwater Road	41.20669	-85.13451
604	15296	4277 U.S. 431	36.52674	-86.88094
604	15301	2180 Catnip Hill Road	37.93207	-84.55888
604	15312	1440 Selinda Avenue	38.189701	-85.697425
604	15316	2113 Helton Drive	35.27001	-87.33084
604	15325	613 Laco Drive	38.065814	-84.538698
604	15328	5244 East 96th Street	39.9271834	-86.0830981
604	15334	1622 Moseley Street	37.76098	-87.1065
604	15340	104 West Sycamore Street	40.2852186	-87.2638326
604	15343	501 Samuel Moore Parkway	39.6202	-86.36165
604	15346	400 S. College Street	36.2003455	-86.2903203
604	15350	2420 Petersburg Road	39.06897	-84.72066

604	15353	4304 East 350 North Road	40.24273	-85.33587
604	15355	3451 S. Indianapolis Road	39.99613	-86.41701
604	15356	759 Beach Croft Road	36.51912	-85.85444
604	15359	4330 West Morris Street	39.749842	-86.2354845
604	15360	1084 Fairview Boiling Springs Road	37.04895	-86.32913
604	15364	141 Bush Rd	36.0928897	-86.6760889
604	15369	2251 East 300 North	39.82719	-85.76381
604	15372	5025 Old Nashville Hwy	35.89488	-86.44914
604	15376	261 Needmore Road	36.58495	-87.3071936
604	15378	271 McCamish Drive	37.67511	-85.86458
604	15379	511 Gardner Lane	37.20663	-86.71548
604	15384	110 Ready Mix Road	37.99143	-86.16108
604	15387	8 Cessna, McDougal Rd	35.06203	-86.56893
604	15394	109 Long Drive	36.35133	-86.70573
604	15396	1550 Old Columbia Road	36.03985	-87.34049
604	15400	445 Industrial Drive	36.1986296	-86.5129926
604	15406	600 Tracy Road	39.5642134	-86.082623
604	15408	380 Harry Berry Lane	36.808824	-87.466044
604	15409	301 Ahlers Drive	40.4152021	-86.9125253
604	15414	5002 Indiana 67	40.03276	-85.72219
604	15419	1204 South Union Street	41.35974	-85.05254
604	15420	3807 Meyer Road	41.05126	-85.0757
604	15422	313 S. 3rd Street	36.75111	-86.18769
604	15435	17050 River Road	40.0352163	-86.0294485
604	15440	11441 Atlantic Road	39.9455731	-85.92156059
604	15447	595 Bells Mill Road	38.03795	-85.67533
604	15449	1503 Rogers Road	39.4045517	-86.4492124
604	15457	1433 Cowan Court	36.18423	-86.77969
604	15460	4700 West 96th Street	39.9260695	-86.2397325
604	15512	613 David Crockett Hwy	35.18164	-86.11702
604	15549	642 Theta Pike	35.9061632	-86.8885696
604	20744	1622 Mason Morrow Millgrove Road	39.16002	-84.25776
604	20753	107 River Circle	39.3366361	-84.6035808
604	20761	4444 N 600 W	39.8318801	-85.9341436
604	20931	160 Jones Blvd	35.27001	-87.33084
725	852	4501 McKinney Falls	30.1897199	-97.7034746
725	15309	4801 Shaw Lane	30.19617	-97.71481
725	15431	2001 Picadilly Dr	30.464708	-97.663316

725	15519	50 CR 258	30.6723436	-97.8825366
725	15544	14411 US-290	30.3501498	-97.4968187
725	15545	6001 Rattlesnake Blvd.	30.7541687	-97.7307413
725	17280	180 Old Post Rd	29.9714035	-97.8716565
725	20739	4901 W Hwy 290	30.1976801	-98.1800932
725	20740	5525 E. State Hwy 71	30.4861686	-98.2119473
725	20743	6975 US-281	30.8462788	-98.2375987
725	20747	1920 N. State Hwy 16	30.7706015	-98.6721139
725	20763	2348 N CR 366	30.629228	-97.475277
725	20984	1515 Landfill Rd	30.7460046	-99.2112212
725	21003	1069 CR 235	30.1694063	-96.8707435
1356	20765	5775 Franklin St	39.8007333	-104.9713491
1356	20769	5775 Airport Rd	39.4719199	-104.9953777
1356	20849	15302 E 25th Dr	39.7542929	-104.8116477
1356	20928	14585 Brighton Road	39.963492	-104.8412207
1356	20929	2600 W Union Ave	39.6314056	-105.0185571
1356	20957	5550 Sheridan Blvd	39.7980605	-105.0505557
1356	21041	1195 Rock Creek Ct	39.9780368	-105.0729159
1356	21042	7291 Colorado Blvd	39.8288715	-104.9412035
1426	20895	7711 Broadway Blvd. SE	34.9746219	-106.6577548
1735	4809	5835 W River Rd	43.1591731	-89.4126113
1735	5125	2245 Stone Quarry Rd	43.2069791	-89.1778793
1735	6031	2975 Kapec Road	43.01697	-89.4791917
2487	1936	2722 Angler Avenue	35.975528	-78.871896
2487	2431	350 Flint Hill Road	35.0856028	-80.9265197
2487	6181	207 Jedburg Road	33.0596084	-80.2384176
2487	6573	124 Moats Fowler Rd.	34.5070595	-82.7585835
2487	15195	4070 Canton Hwy	34.238123	-84.2396731
2487	15223	105 Piedmont Road	34.75906	-82.47717
2487	15228	2825 Humphries Way	33.9263358	-84.2522594
2487	15236	1701 Peeples Street	34.0631246	-81.055586
2487	15237	197 Barnhill Rd	33.99863	-78.34278
2487	15255	7143 Wheat Street Northeast	33.60564	-83.84024
2487	15258	1095 Ozora Road	33.8898155	-83.8959364
2487	15263	450 Woodward Way	34.0766793	-84.0495995
2487	15264	740 Lambert Dr.	33.813508	-84.364034
2487	15265	180 Industrial Boulevard	34.69135	-82.18829
2487	15275	2201 Moon Street	33.849192	-84.226066

2487	15279	520 State Rd 771	34.9913649	-82.0128346
2487	15282	3442 Mount Pisgah Cemetery Rd.	33.9194029	-79.052916
2487	15286	507 Old Montague Lane	35.8010239	-78.5053154
2487	15306	695 Sims Industrial Blvd.	34.0583354	-84.30718
2487	15307	140 Pamela Drive	35.527721	-78.814765
2487	15308	202 Yeager Avenue	33.7908179	-78.9887515
2487	15330	190 Hickory St.	34.2368	-84.4908
2487	15331	719 Worley Road	34.8807912	-82.3898877
2487	15333	42 Forbes Road	32.0749111	-81.0523546
2487	15339	2009 Ronald Regan Blvd	34.1533961	-84.1451831
2487	15348	1020 Winterville Road	33.9513192	-83.3444186
2487	15349	1724 Old Dean Forest Road	32.0896235	-81.1985842
2487	15363	6963 Maddox Road	33.7350123	-84.102398
2487	15366	4324 Toonigh Road	34.0575743	-84.639268
2487	15367	1067 Lincoln Avenue	32.8914719	-79.9768669
2487	15371	993 Academy Church Road	34.1389389	-83.6322151
2487	15381	2454 Daniel Road Southwest	33.689	-84.51409
2487	15385	3955 Buford Highway	33.9779949	-84.1629007
2487	15386	1131 N.West Street	35.7953862	-78.6424783
2487	15397	951 Duncan Road	34.0188181	-84.5766354
2487	15410	615 Gennett Drive	34.4575419	-84.448572
2487	15411	185 Peggy Lane	33.49605	-84.579
2487	15412	455 Maltbie Street	34	-84
2487	15423	605 Rock Quarry Road	33.532145	-84.221057
2487	15424	220 International Drive	35.838233	-78.822664
2487	15425	3701 N.Graham Street	35.2680226	-80.81638989
2487	15429	3960 Thurmon Tanner Rd	34.215847	-83.8858971
2487	15436	1133 Rosedale Drive	33.88013	-84.742457
2487	15437	382 Hightower Parkway	34.3706649	-84.0494205
2487	15443	1430 Marietta Blvd.	33.793665	-84.4324749
2487	15448	28 Benton Field Road	32.2308759	-80.855006
2487	15518	1857 S. Carolina 14	34.899756	-82.2356242
2487	15547	3644 Belvedere Road	32.7619883	-80.1111629
2487	20725	145 Paga Mine Road	34.139167	-84.7774007
2996	2151	301 So 6th	41.6149865	-94.0167262
2996	15551	265 S 13th St	41.5668086	-93.7237263
2996	15552	1301 SW 37th Street	41.65841293334960	-93.80448150634770
2996	15553	1109 East Lincoln Way	42.023804	-93.5983877

2996	15554	4000 Delaware Ave	41.63400650024410	-93.58131408691410
6473	20898	704 SW Wyoming Blvd.	42.8427388	-106.3786733

APPENDIX II: CARBON SAVINGS DISCLAIMER

Carbon Savings Disclaimer

Any figures provided on carbon savings cannot be used for project-specific carbon accounting, and any savings that occurred may have resulted in the sale of carbon credits.

VCUs may be issued for the greenhouse gas emission reductions and removals associated with CarbonCure's solution in the United States of America.

https://www.*carboncure.com/carbon-savings/*

APPENDIX III: SAMPLE CALIBRATION FLOW METER

CarbonCure Technologies
42 Payzant Ave
Dartmouth, NS B3B 1Z6

CARBON CURE™

CERTIFICATE OF CALIBRATION

Serial No.	2019-0135	**Contact**	PoLin Hsu
Model No.	RM1DB	**Title**	Quality Assurance Engineer
Cert. ID	436780135	**Software**	v2.48

COMMENTS: CarbonCure Technologies (CCT) CO_2 Injection Systems are tested as a completed unit, individual components (i.e. sensors, probes, etc.) are noted below for reference.

Pressure Sensors		**Temperature Transmitter**	
Part No.	P1 PT2443	**Part No.**	902044/25
	P2 PT2443	**Man.**	Jumo
	P3 PT2443		
	P4 PT2443	**Machined Orifice**	
	P5 PT2443 (if applicable)	**Part No.**	Single
Man.	P1 IFM	**Serial No.**	2019-0135
	P2 IFM		
	P3 IFM		
	P4 IFM		
	P5 IFM (if applicable)		

Liquid Solenoid Valve		**Gas Solenoid Valve**	
Part No.	EH70-8-A-A	**Part No.**	8223P003
Man.	Clark Cooper	**Serial No.**	ASCO Valves

CO_2 Vessel Information		**Liquid CO_2 Properties**	
Model No.	Perma-Cyl 1000	**Initial Press.**	305 PSI
Serial No.	GP-529020	**Initial Temp.**	-13 DegF

COMMENTS:

Calibration Results: Tested **Date:** 08/01/19

DATE OF ISSUE: 08/01/19

SIGNATURE: PoLin H

PoLin Hsu, EIT
Quality Assurance Engineer
CarbonCure Technologies

APPENDIX IV: SAMPLE CALIBRATION SCALES

CAPITOL SCALE COMPANY

2744 PEARL CT
SUN PRAIRIE, WI 53590

Precision Measurement / Industrial Automation

(608) 837-4848 1-888-953-5333 Fax: (608) 837-4830

REPORT OF INSPECTION AND CALIBRATION

CLIENT INFORMATION	
CUSTOMER NAME	Wingra (Plant 1)
STREET ADDRESS	2975 Kapec Road
CITY, STATE ZIP	Fitchburg, WI 53719

EQUIPMENT INFORMATION							
TYPE OF DEVICE	DIGITAL HOPPER	CLASS	IIIL	SERIAL #	CB263564		
MANUFACTURER	ALKON	CAPACITY	10,000	MAX LOAD	6,000	UNIT	lb
MODEL #	SPECTRUM VI/ EZ-CAL	MIN DIV.	10	MATERIAL	Cement		

VISUAL INSPECTION	ACCEPT	REJECT
FUNCTIONALITY; AS LEFT	X	
REPEATABILITY/SENSITIVITY;AS LEFT	X	
PHYSICAL CONDITION; AS LEFT	X	
SUITABILITY FOR INTENDED USE	X	

NIST TRACEABLE TEST STANDARDS USED THIS CALIBRATION		
WEIGHT	CALIBRATION DUE DATE	TEST REPORT #
500 LB - B01-B08	6/30/2023	W21-212

ENVIRONMENTAL CONDITIONS					
TEMPERATURE (Degrees):	N/A	HUMIDITY:	N/A	STANDARD USED:	N/A

SUBSTITUTION WEIGHT (lbs.)		STANDARD WEIGHTS APPLIED (lbs.)		TOTAL WEIGHT (lbs.)	ERROR AS FOUND (lbs.)	ERROR AS LEFT (lbs.)	TOLERANCE (lbs.)
0	+	0	=	0	NEW	0	0
0	+	500	=	500	INDICATOR	0	+/- 10
0	+	1000	=	1000		0	+/- 10
1000	+	1000	=	2000		0	+/- 10
2000	+	1000	=	3000		0	+/- 10
	+		=				
	+		=				
	+		=				
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	+		=				
	+		=				
	+		=				
				PASS / FAIL	PASS	PASS	

SERVICE TECHNICIAN'S COMMENTS/OBSERVATIONS/OPINIONS	CORRECTED +5 LB @ 2000 LB

This report was completed on 12/6/2022 (Date) by Cody Playter (Capitol Scale Representative) / 294305-WC (License #).

Next Full Calibration is due Dec-23 (Date). The serial number of this report: 12622W-C-263564.

REVISION D 4.2.2020 CAPITOL SCALE CO. - QUALITY PROCEDURE MANUAL - CONTROLLED DOCUMENT Report # C-420 (File # 4.20C)

APPENDIX V: TESTING PROCEDURE

CarbonCure and the producers in the project boundary will implement a testing procedure (at either a lab or the Corporation's plants) that measures quantities of cement needed to produce concrete with equivalent compressive strength both with and without the project processes to establish a ratio of Project Scenario:Baseline Scenario cement use. The test batches will yield the same levels of compressive strength (or have the project-level mix have a greater strength than the baseline).

<u>Determining qCement,p,i,test n</u>

qCement,p,i,test n will be determined by measuring the quantity of cement used to prepare project compressive strength test specimen n based on project mix design i, where the measurement of the quantity of cement and preparation, curing, and testing of the test specimen meet the requirements of the ASTM concrete standard test method for compressive strength relevant for the type of concrete in question[2]. For the applicable project mix design, a minimum of three batches will be tested and the three tests will be within 10% of each other in compressive strength for a given CarbonCure Mix Design. In all cases the number of batches and specimens tested will meet or exceed the requirements of the relevant ASTM standard test method.

This determination (for both qCement,b,I,test n and qCement,p,I,test n) will be done once during the project crediting period for the CarbonCure Mix Designs that comprise 50% or more of the Corporation's concrete production (it may also be done at the Division level of the Corporation).

<u>Determining qCement,b,i,test n</u>

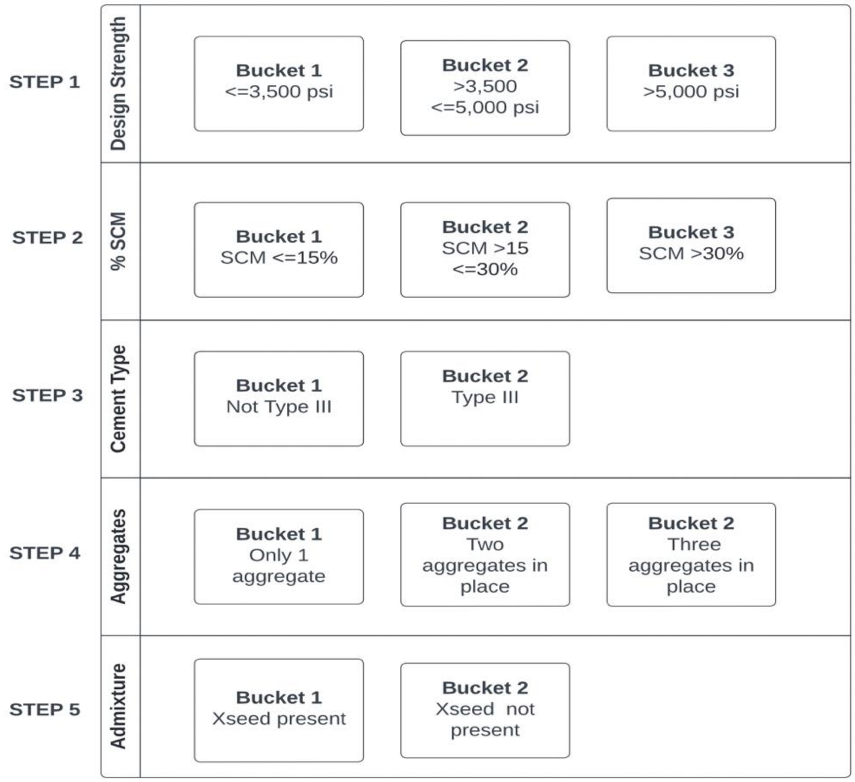
qCement,b,i,test n will be determined by measuring the quantity of cement used to prepare baseline compressive strength test specimen n based on a mix design that is intended to result in a concrete of equivalent compressive strength to project mix design i, where the measurement of the quantity and preparation, curing, and testing of the test specimens are identical to what is used for the determination of qCement,p,i,test n.

Test specimens will all be of the same volume, and equal to the volume of the specimens used to determine qCement,p,i,test n. The same number of specimens across the same number of batches as tested for qCement,p,i,test n will be tested. Baseline test specimens will have an average 28-day compressive strength that is equal to or less than the average 28-day compressive strength determined for the project test specimens used in determining qCement,p,i,test n. Where the average baseline test specimen compressive strength is greater than the average project test specimen compressive strength after completing at least three tests for a given mix design, the producer will conduct additional testing of either the project or baseline mix design (discarding an equivalent number of initial test specimen results for either the project or baseline as applicable) until the average project compressive strengths is equal to or greater than the baseline level strength.

CarbonCure Mix Designs

As concrete producers can have many different mix designs which are similar in performance, mix designs will be aggregated into CarbonCure Mix Designs based on their criteria (design strength (psi), cement type (e.g., type I/II), % SCMs, blend of aggregates (e.g. coarse+fine), strength enhancing admixtures (e.g. Xseed)), resulting in multiple mix designs leveraging the same compressive strength testing. This is used to determine the cement cuts, that is the difference between the baseline and project scenarios, specifically, CarbonCure will a) for the CarbonCure Mix Designs that this testing noted above was conducted for, use the results of the testing data to quantify the cement cut; or b) for the CarbonCure Mix Designs that this testing was not conducted for, Carboncure will use the average cement cut from (a) (that is, the CarbonCure Mix Designs that conducted the testing) but apply a 1 standard deviation deduction to ensure conservatism. For the calculations in step (a) (that is, the CarbonCure Mix Designs that conducted the testing), CarbonCure will calculate the values based on the averages demonstrated by the testing (e.g. if three tests were conducted for a given mix design and each respective test demonstrated a cement cut of 5.0%, 4.5% and 4.0%, CarbonCure would assume the average from these tests or 4.5%).

CarbonCure has a five step process for aggregating mixes into CarbonCure Mix Designs. This five step process results in a total of 108 possible unique combinations as demonstrated below.



The groupings and buckets in CarbonCure mix designs are based on the National Ready Mixed Concrete Association (NRMCA) benchmark report. The NRMCA is the leading industry association for ready-mix producers. They perform industry surveys that capture a statistically significant sample of ready-mix plants, the surveys provide the average distribution of plants and mixes that coincide with the buckets used to group mix families/CarbonCure mix designs. The report will be made available to a VVB upon request.

Additionally, CarbonCure has several industry experts attest to CarbonCure mix designs, their groupings as they relate to industry standards and their credibility within the concrete industry. These experts include the largest and most well established suppliers of concrete in the USA as well as technical advisors and mix design experts in the concrete space. These attestations will be made available to a VVB upon request.

Note on Required Average Compressive Strength (RACS): At the time of the writing of this PD, a revision to VM0043 is currently pending at Verra that would allow project proponents to use RACS as opposed to the currently-outlined testing procedure in VM0043. Should that amendment be approved by Verra, CarbonCure will use this as an additional approach under this project activity to determine functional equivalence at some or all of the sites within the project boundary.