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Indigo US Project No. 1

4th Reporting Period

Results through harvest 2023

Harnessing nature to help farmers sustainably feed the planet

CAR1459

indigo MONITORING REPORT

PROJECT MONITORING REPORT 4

Indigo U.S. Project No.1

Project Name	Indigo U.S. Project No. 1
Project ID	CAR1459
Document Version	v4.5 (the 4th verification period)
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Time Period Covered	Jun 12, 2018 to Dec 31, 2023
Crediting Program	Climate Action Reserve
Protocol Version	Soil Enrichment Protocol, Version 1.1
Prepared By	Indigo Ag. Inc.
Contact	500 Rutherford Ave. Boston, MA 02129 +1 (844) 828-0240

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1 Project summary

The Indigo U.S. Project No. 1, identified in the registry system as CAR1459, (hereafter the "Project") is a greenhouse gas (GHG) emission reduction project, developed according to the requirements of the Climate Action Reserve's Soil Enrichment Protocol, Version 1.1, that aims to reduce net emissions of CO_2, CH_4, and N_2O and to enhance soil organic carbon (SOC) sequestration on agricultural lands through the adoption of sustainable agricultural land management activities. Indigo has designed this soil enrichment project with a complete, consistent, transparent, accurate, and conservative quantification of GHG emissions reductions and removals. This Monitoring Report communicates the quantification results from the Project during the current reporting period as well as the overall crediting period to date.

The Project currently includes 1,086 enrolled growers who carry out agricultural management on 1,517,893 acres in 20,248 fields located in the primary agricultural regions of the United States (see the Monitoring Plan v4.5 for details). The Project has 24,088 fields that are being monitored for permanence. The total emissions reduced and removed by growers participating in CAR1459 over the course of the entire crediting period, up to and including the current reporting period under verification, are 927,367 tCO_2e (comprised of 968,442 tCO_2e and -41,075 tCO_2e reversible and non-reversible emission reductions, respectively), and 140,418 tCO_2e were contributed to the buffer pool; the cumulative credits (after accounting for reversals and any other adjustments) is 927,296 tCO_2e (Table 14). Results for the current verification are summarized in Table 1.

Table 1: Summary results for the 4th verification of CAR1459

Non-Reversible Emission Reductions (ER_{NonRev})	**Reversible Emission Reductions** (ER_{Rev})	**Buffer Pool Contribution** (fraction)	**Buffer Pool Contribution** (credits)	**Credits Generated**	**Adjustments** (see Sec. 3.2)	**Net Active Credits to be Issued**
-858	631,563	0.145	91,574	630,705	71	539,060

The states included in this reporting period are as follows: Alabama, Arkansas, Colorado, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Wisconsin.

Table 2 summarizes the project data before any adjustments are made outside of the quantification of the current reporting period (e.g., deductions made to compensate for reversals of previously-issued credits). If there are no adjustments, then these figures will match those entered into the Climate Action Reserve's registry system for the current reporting period. These results are consistent with the results found in this document and the data submission package. Any adjustments are discussed in Section 3.2.

Table 2: Vintage-level credits generated in the 4th reporting period

	Credits Generated		
Vintage	Reversible	Irreversible	**Total**
2018	452	24	476
2019	3,983	−131	3,852
2020	14,389	165	14,554
2021	43,093	−567	42,526
2022	208,256	2,437	210,693
2023	361,390	−2,786	358,604

This document summarizes the Project's quantification results based on the equations listed in Section 5.4 Results of Quantification in the Monitoring Plan v4.5 and Section 5 of the Soil Enrichment Protocol, Version 1.1. The full details of the project results are contained in the data submission package provided to the verifier, which contains the data and parameters that were necessary to enable credit generation for this Project. For any additional details or inquiries, please contact the Indigo team directly as listed below.

Table 3: Project developer contact information

Organization name	Indigo	Indigo
Contact names	Max DuBuisson	Ryan Pape
Title	Head of Impact and Integrity	Sustainability MRV Manager
Address	Indigo Ag. Inc. 500 Rutherford Ave. Boston, Massachusetts 02129	Indigo Ag. Inc. 500 Rutherford Ave. Boston, Massachusetts 02129
Telephone	(844) 828-0240	(844) 828-0240
Email	mdubuisson@indigoag.com	rpape@indigoag.com

1.1 Project activities

As detailed in Chapter 3 of the Monitoring Plan v4.5, project activities are changes in agricultural land management that are expected to increase SOC storage and reduce emissions of CO_2, CH_4, and/or N_2O over the crediting period of a field (activities are listed in Table 4 below). The net impacts of project activities are quantified through the combination of soil sampling, modeling, and default equations, resulting in incentive payments to participating growers based on their fields' performance during the reporting period. These impacts are quantified through the Soil Enrichment Protocol, Version 1.1 if the respective field met the eligibility requirements outlined in Section 2.2 and Section 3 of the SEP v1.1.

Project growers must adopt one or more of the practice changes detailed in Table 4 for each individual field they enroll into the Project.

Table 4: List of Project Activities eligible in current reporting period

Practice category	**Practice**
Crop planting and harvesting	New cover crop adoption Adding a legume species to existing cover crop Longer duration of cover crops through delayed termination Longer duration of cover crops through earlier planting New crops in rotation
Tillage and residue management	Tillage reduction through number of passes Tillage reduction through delayed tilling Tillage type change to lessen disturbance
Nitrogen application	Change in nitrogen application method Change in nitrogen application timing Addition of nitrogen stabilizer or inhibitor

2 Variances, Guidance, and Modifications

Indigo strives to maintain conformance with all requirements of the Soil Enrichment Protocol, Version 1.1 (SEP v1.1) during each reporting period. However, the project may encounter situations where protocol guidance is not clear, or experience implementation issues, whether scientific, meteorological, human, or technological, which require some form of guidance, clarification, and/or protocol variance. To provide full transparency into this process, this section explains any approved variances and/or registry guidance relevant to the current period under verification. Further,

modifications that have been made to the documentation, quantification or infrastructure supporting the Project are reported below.

2.1 Approved Variances

Indigo has not sought approval from the Climate Action Reserve (CAR) for a variance under SEP v1.1 for this verification period but is operating under guidance from a previously approved variance request related to the project's handling of project fields with grazing events. This approval and request can be found as a public document associated with CAR1459 on the CAR portal labeled `2023-VAR-DET-CAR1459.pdf`.

2.2 Registry Guidance

During the normal course of project development it is often necessary for Indigo to request guidance from CAR to clarify protocol language or provide interpretations to accommodate Project circumstances that are not obviously addressed by the SEP v1.1. Any written guidance relevant to this verification period is detailed in `IndigoCarbon_US-1_2023_0067a` (as referenced in Section 3.11 Variances, Guidance and Modifications of the Monitoring Plan v4.5).

2.3 Reporting Modifications

Lessons learned, guidance received, and/or advancements (both scientific and technological) may result in modifications to the Project documentation, quantification or infrastructure as compared to prior verification periods. This continuous improvement is desirable, ensuring the Project aligns with the current best practices and successfully generates verified carbon credits under the Soil Enrichment Protocol, Version 1.1 in an efficient and cost-effective manner. Indigo has detailed any notable changes between the current reporting period (RP4) and the previous reporting period in Table 3.4 of the Monitoring Plan v4.5.

3 Quantification Results for the 4th Reporting Period

Quantification for each source included in the Project (as defined in Section 4.0 GHG Assessment Boundary of the Monitoring Plan v4.5) was completed through the use of both default equations and biogeochemical modeling.

The data inputs and parameters for the equations used in quantification were collected and derived from multiple sources, namely, direct soil measurements based on the Project sampling design as well as field-level management data from every field within the scope of the verification. The biogeochemical model was used for the quantification of changes to sources within the scope of the relevant model validation report at the sampled points, while non-modeled GHG sources were quantified through the default equations. All equations and parameters used to conduct quantification for this Project are listed in Section 5.4 Results of Quantification of the Monitoring Plan v4.5, while all quantification results, including leakage and uncertainty deductions, are provided in the following sections. Specifically, Tables 1, 2 and 5 display the final emissions reductions (credits) achieved by this Project and the remaining tables represent the intermediate (stratum) results following the requirements of the SEP v1.1. In the tables below, the stratum results may not sum to the total results of the Project due to rounding.[1]

[1]Numerical results are rounded in Section 3 Quantification Results for the 4th Reporting Period for display purposes. In the data submission package, no rounding is done until the end of the credit calculation process, when reversible credits, non-reversible credits, and buffer pool contribution are rounded down at the vintage level.

3.1 Reporting Period Quantification Results

Table 5 replicates Table 1.2 in Section 1.2 Summary Description of the Project of the Monitoring Plan v4.5. All results displayed in this document and the data submission package were required to achieve the total credit result listed of 630,705 .

Table 5: Project summary results for the 4th reporting period

	Growers	**Fields**	**Area** (acres)	**Credits Generated** (tCO_2e)	**Buffer Pool Contribution** (tCO_2e)	**Start Date**	**End Date**
4th RP	1,086	20,248	1,517,893	630,705	91,574	Jun 12, 2018	Dec 31, 2023

3.1.1 Reversible and Non-Reversible Emission Reductions

This section follows the equations listed in Subsection 3.1.5 Uncertainty and Leakage Deduction of the Monitoring Plan v4.5.

The results for both reversible and non-reversible emissions reductions, as indicated in SEP Equations 5.2 and 5.6, can be found in Table 6 below. The results in this table require the use of the leakage and uncertainty deductions; these results are established for the Project and can be found in Subsubsection 3.1.5 Uncertainty and Leakage Deductions.

As described in the Monitoring Plan v4.5, the results in Table 6 indicate whether a reversal occurred in the Project (as required through Equation 5.5 of the SEP v1.1). As ER_{Rev} was not negative in this reporting period, Indigo was not required to compensate for any project-level reversal obligations.

Table 6: Reversible and non-reversible emission reductions by stratum in the 4th reporting period. $\text{ER}_{\text{Rev},s,t}$ and $\text{ER}_{\text{NonRev},s,t}$ show design-based estimates (see Table 8 for details). The areal averages are computed by dividing the estimated total emissions reduction by the area, $A_{s,t}$, of the field boundaries in stratum s as of this reporting period t. The totals of $\text{ER}_{\text{Rev},s,t}$ and $\text{ER}_{\text{NonRev},s,t}$ differ from the values of ER_{Rev} and $\text{ER}_{\text{NonRev}}$ in Table 1 because the latter is the result of rounding vintage-level credits down to the nearest integer (to produce Table 2).

	$\text{ER}_{\text{Rev},s,t}$ (tCO_2e)	$\text{ER}_{\text{NonRev},s,t}$ (tCO_2e)	$\Delta CO2\_\text{soil}_{s,t}$ (tCO_2e)	$\overline{\Delta CH4_{s,t}}$ (tCO_2e/acre)	$\overline{\Delta N2O_{s,t}}$ (tCO_2e/acre)	$\overline{\Delta CO2\_\text{NR}_{s,t}}$ (tCO_2e/acre)	$A_{s,t}$ (acres)
Stratum A	21,206.3	−4,150.9	21,206.3	−0.066	−0.027	−0.001	51,747.9
Stratum B	90,970.6	−10,219.1	90,970.6	−0.024	−0.038	−0.001	187,852.1
Stratum C	6,804.1	595.4	6,804.1	−0.008	0.033	0.005	23,474.8
Stratum D	24,633.8	−20.8	24,633.8	−0.012	0.013	−0.001	54,738.8
Stratum E	101,059.5	−429.6	101,059.5	−0.015	0.012	−4.985	161,551.1
Stratum F	240,138.7	9,785.9	240,138.7	−0.003	0.014	0.007	639,386.0
Stratum G	146,752.7	3,585.0	146,752.7	−0.008	0.017	0.002	399,142.7
Total	631,565.7	−854.0	631,565.7				1,517,893.4

3.1.2 Soil Organic Carbon Stock Change

This section follows the equations listed in Subsection 5.4.2 Soil Organic Carbon Stock Change of the Monitoring Plan v4.5.

The results for the soil organic carbon stock change, as indicated in SEP Equation 5.3, can be found in Table 7 below. The results in this table require stratum areas (as listed in Table 6) and use a key parameter: the uncertainty deduction, which is established for the Project and can be found in Subsubsection 3.1.5 Uncertainty and Leakage

Deductions. Note that soil organic carbon was quantified through the use of biogeochemical modeling with the DayCent-CR model. The first column of table 7 shows the quantity that appears inside the sum in Equation 5.3 of the SEP v1.1:

$$\Delta CO2\_\text{soil}_{s,t} := \left(\overline{\Delta SOC_{s,t}} - \overline{\Delta SOC_{\text{bsl},s,t}}\right) \times A_{s,t} \times (1 - UNC_t). \quad \text{(MR-1)}$$

Table 7: Soil organic carbon stock change by stratum in the 4$^{\text{th}}$ reporting period. The areal averages are computed by dividing the total by the area of field boundaries in each stratum (i.e., $A_{s,t}$ in Table 6). $\Delta CO2\_\text{soil}_{s,t}$ is computed using Equation (MR-1).

	$\Delta CO2\_\text{soil}_{s,t}$ (tCO_2e)	$\overline{\Delta SOC_{s,t}}$ (tCO_2e/acre)	$\overline{\Delta SOC_{\text{bsl},s,t}}$ (tCO_2e/acre)
Stratum A	21,206.3	0.51	0.04
Stratum B	90,970.6	0.60	0.03
Stratum C	6,804.1	0.72	0.38
Stratum D	24,633.8	0.33	−0.19
Stratum E	101,059.5	0.44	−0.29
Stratum F	240,138.7	0.48	0.04
Stratum G	146,752.7	0.28	−0.14

To attribute SOC emission reductions to fields for the purposes of allocating credits to growers (for calculating payments and tracking reversals), Indigo developed an emulator of DayCent-CR that could be applied both to fields that were selected for soil sampling (and thus had point-level DayCent-CR results) as well as fields that were not selected for soil sampling (and thus did not have DayCent-CR results) as allowed by SEP v1.1. Specifically, Indigo fit a gradient-boosting decision tree model that uses practice changes to predict DayCent-CR SOC emission reductions. For consistency, Indigo used emulator predictions of SOC emission reductions for all fields in the Project to make field attributions. This emulator is updated with each verification based on the quantification results of the relevant time period.

To compute field attributions, attributions to management zones and cultivation cycles were scaled to sum to the "design-based estimate" of the total SOC emission reductions that was quantified using the sample design and DayCent-CR predictions at sample points. These attributions were pro-rated to calendar years and summed at the annual level to compute vintage-level credit totals. Indigo rounded these vintage-level totals by rounding down to the nearest integer (i.e., the "floor" operation), per guidance from CAR. The final vintage-level credit results are reflected in Table 2, while the buffer pool contribution is reported here only at the project level, in Table 1. Finally, the management zone and cultivation cycle attributions were scaled a second time so that they sum to the vintage credit totals, and these attributions were then used to generate field attributions. The right-hand column of Table 8 shows the stratum-level totals of those attributions. As a result of rounding credits down at the vintage level, the total of the right-hand column of Table 8 is slightly smaller than the total of the left-hand column, which is erring on conservatism. Note that the variance of the total SOC emissions reduction, and thus the uncertainty deduction, was calculated with the statistical sample design estimates and not the field attributions.

3.1.2.1 Correction for SOC impacts of livestock grazing As described in Sec. **??** of the Monitoring Plan v4.5, Indigo applied a correction to DayCent-CR's predictions of SOC stock change to account for livestock removing some biomass via grazing and therefore reducing how much SOC accrues. The results of that correction are reported in Table 9. In this reporting period, we estimated that 19,957.4 tCO_2e of SOC would have accumulated in the project scenario were it not for the livestock grazing, and 9,997.0 tCO_2e of SOC would have accrued in the baseline were it not for the livestock grazing. These quantities get subtracted from DayCent-CR's estimates of SOC accrual (see Table 9). On net, the impact of correcting for grazing is to change SOC emissions reduction by $-1 \times 19,957.4 - (-1 \times 9,997.0) \approx -9,960.4$ tCO_2e. Note that multiplying the emissions reduction in the SOC pool corrected for grazing (i.e., the bottom row of Table 9: 735,854.0 tCO_2e) by $(1 - UNC_t)$ (retrieved from Table 12) gives the total of $\Delta CO2\_\text{soil}_{s,t}$ in Table 6.

Table 8: Two notions of emissions reduction of SOC after applying the uncertainty deduction: The design-based estimates following Eq. (MR-1) and Eq. 5.3 of the SEP estimate the stratum-level averages using model runs at sample points. Meanwhile, the result of subsequent transformations (attributing emissions reduction to zones and cultivation cycles, rounding the vintage-level totals down to the nearest integer, and scaling the zone-cycle–level totals to equal those rounded vintage totals) produces slightly different results when aggregated to the stratum level (second column). The totals differ slightly because rounding was applied in calculating vintage-level credits, which affects the second column but not the first.

	Two notions of emissions reduction of SOC after uncertainty deduction	
	Design-based estimate of $\Delta CO2\_soil_{s,t}$	attribution of SOC em. red. $\times (1 - UNC_t)$
Stratum A	21,206.3	22,752.7
Stratum B	90,970.6	99,370.8
Stratum C	6,804.1	12,320.4
Stratum D	24,633.8	23,729.3
Stratum E	101,059.5	93,366.6
Stratum F	240,138.7	250,287.7
Stratum G	146,752.7	129,735.6
Total	631,565.7	631,563.0

Table 9: Correction to DayCent-CR's estimate of SOC stock change to account for the biomass carbon removed by grazing livestock

	Estimate (tCO_2e)
Project Scenario:	
SOC stock change over time according to DayCent-CR	685,939.0
− SOC that would have accrued if not for livestock grazing	19,957.4
= SOC stock change over time corrected for grazing	665,981.6
Baseline Scenario:	
SOC stock change over time according to DayCent-CR	-59,875.4
− SOC that would have accrued if not for livestock grazing	9,997.0
= SOC stock change over time corrected for grazing	-69,872.4
Emissions reduction:	
SOC stock change over time in project corrected for grazing	665,981.6
− SOC stock change over time in baseline corrected for grazing	-69,872.4
= Emissions Reduction of SOC corrected for grazing	735,854.0

3.1.3 Methane Emission Reductions

This section follows the equations listed in section 5.4.3 of the Monitoring Plan v4.5.

The results for methane emission reductions, as indicated in SEP Equation 5.7, can be found in Table 10. Note that methane emissions reductions were quantified through the use of default equations for this reporting period.

3.1.4 Nitrous Oxide Emission Reductions

This section follows the equations listed in Section 5.4.4 Nitrous Oxide Emission Reductions of the Monitoring Plan v4.5.

The results for nitrous oxide emission reductions, as indicated in SEP Equation 5.16, can be found in Table 11 below. Direct nitrous oxide emissions reductions were quantified through the use of DayCent-CR (with default equations 5.20 and 5.25 in the SEP used in every management zone outside DayCent-CR's validation domain for direct N_2O

Table 10: Methane emission reductions by stratum in the 4th reporting period

	$\overline{\Delta CH4_{s,t}}$ (tCO_2e/acre)	$\overline{\Delta CH4\_md_{s,t}}$ (tCO_2e/acre)	$\overline{\Delta CH4\_ent_{s,t}}$ (tCO_2e/acre)	$\overline{\Delta CH4\_bb_{s,t}}$ (tCO_2e/acre)
Stratum A	−0.066,0	−0.001,46	−0.064,5	0.0
Stratum B	−0.024,5	−0.000,556	−0.023,9	2.53×10^{-5}
Stratum C	−0.008,07	−0.000,168	−0.007,90	0.0
Stratum D	−0.012,0	−0.000,347	−0.012,4	0.000,681
Stratum E	−0.015,3	−0.000,331	−0.015,1	8.58×10^{-5}
Stratum F	−0.003,22	-6.73×10^{-5}	−0.003,19	3.43×10^{-5}
Stratum G	−0.008,35	−0.000,144	−0.007,56	−0.000,655

and at sample points when model QC checks failed). Indirect nitrous oxide emissions reductions were quantified through the use of default equations.

Table 11: Nitrous oxide emission reductions by stratum in the 4th reporting period

	$\overline{\Delta N2O_{s,t}}$ (tCO_2e/acre)	$\overline{\Delta N2O\_input_{s,t}}$ (tCO_2e/acre)	$\overline{\Delta N2O\_bb_{s,t}}$ (tCO_2e/acre)
Stratum A	−0.026,6	−0.026,6	0.0
Stratum B	−0.038,2	−0.038,2	6.24×10^{-6}
Stratum C	0.033,1	0.033,1	0.0
Stratum D	0.012,6	0.012,4	0.000,167
Stratum E	0.012,3	0.012,3	2.19×10^{-5}
Stratum F	0.014,4	0.014,4	8.39×10^{-6}
Stratum G	0.016,6	0.016,7	−0.000,161

3.1.5 Uncertainty and Leakage Deductions

This section follows the equations listed in section 5.5 and 5.4.6 of the Monitoring Plan v4.5.

Table 12 provides the results for the both the leakage and uncertainty deduction of the Project. These results are required by SEP Equations 5.2, 5.3 and 5.6 (as referenced above in Subsubsection 3.1.1 Reversible and Non-Reversible Emission Reductions and Subsubsection 3.1.2 Soil Organic Carbon Stock Change).

Table 12: Uncertainty and leakage deductions in the 4th reporting period

Parameter	**Uncertainty deduction** (UNC_t)	**Leakage deduction** (LE_t)
Value	14.17%	0.00%

3.2 Reported Reversals and/or Other Adjustments

3.2.1 Reversals During the Current Reporting Period

As described in Sections 3.9 and 6.6.2 of the Monitoring Plan v4.5 and in `IndigoCarbon_US-1_2023_0050`, Indigo monitors all fields after the end of their crediting period to identify any changes to land use or land management that constitute a reversal. For avoidable reversals, Indigo will coordinate with the Climate Action Reserve for compensation per Section 5.3.2.1 of the SEP v1.1. Unavoidable reversals are compensated per Section 5.3.2.2 of the SEP v1.1.

Table 13: Summary of reversals during the 4th reporting period

	Total fields affected	**Total reversals** (CRTs)
Avoidable Reversals	8	71
Unavoidable Reversals	0	0
Total	8	71

4 Crediting Period Quantification Results

Table 14 shows the results of the crediting period to date, including the current reporting period.

Table 14: Project summary results for all reporting periods

Reporting Period	**Growers**	**Fields**	**Area** (acres)	**Credits Issued** (tCO_2e)	**Buffer Pool Contribution** (tCO_2e)	**Start Date**	**End Date**
1st	175	1,184	100,372	22,225	3,291	Mar 30, 2018	Dec 31, 2020
2nd	427	5,083	423,740	111,389	18,678	May 08, 2018	Dec 31, 2021
3rd	972	15,766	1,289,361	163,048	26,875	Apr 18, 2018	Dec 31, 2022
4th	1,086	20,248	1,517,893	630,634	91,574	Jun 12, 2018	Dec 31, 2023
Total				927,296	140,418		

A Appendix: Summary Quantification Flow Diagram

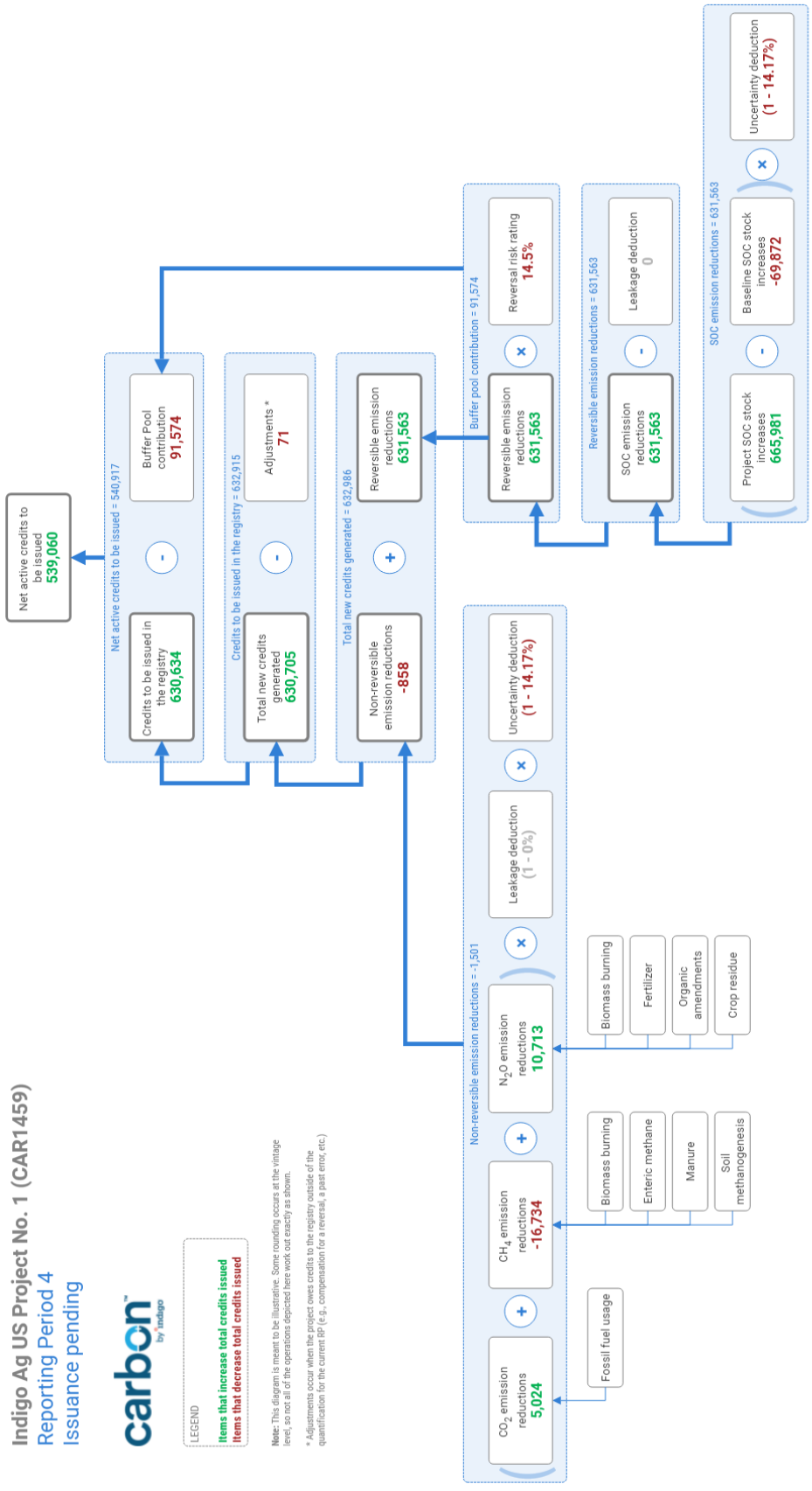

Figure 1: Summary diagram of the quantification flow for CAR1459.