# Environmental Product Declaration

*The Andersons*

# Calcium Nitrate

ASTM INTERNATIONAL

According to
ISO 21930
ISO 14025

## 1. General Information

| | |
|---|---|
| **Manufacturer Name:** | The Andersons |
| **Program Operator:** | ASTM International<br>100 Barr Harbor Drive<br>West Conshohocken, PA<br>19428-2959, USA |
| **Declaration Number:** | EPD 445 |
| **Reference PCR:** | ISO 21930: 2017 |
| **Date of Issuance:** | March 31, 2023 |
| **End of Validity:** | March 31, 2028 |
| **Product Name:** | Calcium Nitrate Admixture |
| **EPD Owner:** | The Andersons |
| **Declared Unit:** | 1000 kg's of The Andersons Calcium Nitrate |
| **EPD Scope:** | Cradle-to-gate (A1, A2, and A3) |
| **Verification:** | ISO 21930 serves as the core PCR. Independent verification of the declaration according to ISO 14025 and ISO 21930. ☐ internal ☒ external |
| **LCA Reviewer and EPD Verifier:** | Timothy S. Brooke<br>ASTM International |



ASTM INTERNATIONAL

# 2. Product

### 2.1 Product and Company Description

The Andersons are a plant nutrient company that produces a range of dry and liquid industrial products that are used for a variety of applications.The company has been manufacturing and distributing chemicals to the industrial market for over 30 years. One of the products produced by the Andersons is a Calcium Nitrate solution that can be used for concrete admixtures and ready mix concrete production.

# 3. LCA Calculation Rules

### 3.1 Declared Unit

The declared unit is 1000 kgs of Calcium Nitrate produced at The Andersons's manufacturing facility.

### 3.2 System Boundary

The system boundary for this study is limited to a cradle-to-gate focus. (see also Table 4):

- ***A1 Raw material supply***: Extraction, handling, and processing of input materials.
- ***A2 Transportation****:* Transportation of all input materials from the suppliers to the gate of the manufacturing facility.
- ***A3 Manufacturing*****:** The preparation processes of The Andersons' manufacturing facility. This phase also includes the operations of the manufacturing facility and all process emissions that occur at the production facility.

### 3.3 Estimates and Assumptions

All significant foreground data was gathered from the manufacturer based on measured values.

### 3.4 Cut-off Criteria

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930: 2017 Section 7.1.8. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.

No material or energy input or output was knowingly excluded from the system boundary.

### 3.5 Background Data and 3.6 Data Quality

Data was gathered for the primary material and energy inputs used in production for calendar year 2021. Table 1 describes each LCI data source for raw materials (A1), transportation (A2) and the core manufacture process (A3). Table 3 also includes a data quality assessment for on the basis of the technological, temporal, and geographical representativeness.

**Table 1: Secondary Data Sources and Data Quality Assessment**

**A1: Raw Material Inputs**

| Inputs | LCI Data Source | Geography | Year | Data Quality Assessment |
|---|---|---|---|---|
| **Lime** | Ecoinvent 3.7: Lime {GLO}\| market for \| Cut-off, U | US | 2017 | **Technology:** good<br>**Time:** very good<br>Data is <5 years old<br>**Geography:** very good<br>Data is representative of grid specific conditions. |
| **Nitric Acid** | Ecoinvent 3.7: (67% Nitric acid, without water, in 50% solution state {GLO}\| market for \| Cut-off, U, 33% Tap water {RoW} \|market for \| Cut-off) | Global | 2017 | **Technology:** very good<br>**Time:** very good<br>Data is <5 years old<br>**Geography:** very good |
| **Water** | Tap water {RoW} \|market for \| Cut-off | Global | | **Technology:** very good<br>**Time:** very good<br>Data is <5 years old<br>**Geography:** very good |

**A2: Transportation**

| Inputs | LCI Data Source | Geography | Year | Data Quality Assessment |
|---|---|---|---|---|
| **Trucking** | USLCI: Transport, single unit truck, short-haul, diesel powered, Northwest/tkm/RNA | North America | 2014 | **Technology:** very good<br>**Time:** good<br>Data is <10 years old<br>**Geography:** good |
| **Rail** | USLCI: Transport, train, diesel powered/US | North America | 2014 | **Technology:** very good<br>**Time:** good<br>Data is <10 years old<br>**Geography:** good |

| A3: Manufacturing/Ancillary | | | | |
|---|---|---|---|---|
| **Energy** | **LCI Data Source** | **Geography** | **Year** | **Data Quality Assessment** |
| **Electricity** | ecoinvent 3.7: Electricity, medium voltage, at grid, [RFC] | US | 2018 | **Technology:** very good<br>**Time:** good<br>Data is <5 years old<br>**Geography:** very good |
| **Natural Gas** | USLCI: Natural gas, combusted in industrial boiler/US | US | 2014 | **Technology:** very good<br>**Time:** good<br>Data is <10 years old<br>**Geography:** very good. |

### 3.7 Period under Review

Data was gathered for the primary material and energy inputs used in the production for calendar year 2021.

### 3.8 Allocation

At The Andersons production facility several different products are produced. Since the primary data for manufacturing was only available on a facility level, the environmental load among the products produced is allocated according to its mass. For waste that is recycled, the 'recycled content approach' was chosen. The recycling of waste generated by the product system is cut off.

### 3.9 Comparability

This LCA was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel types used.

It is noted that EPDs are comparable only if they comply with ISO21930:2017 use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

## 4. LCA Results

Life cycle impact assessment (LCIA) is the phase in which the set of results of the inventory analysis – the inventory flow table – is further processed and interpreted in terms of environmental impacts and resource use inventory metrics.Table 2 and 3 below summmarizes the LCA results for the cradle-to-gate (A1-A3) product system. Additionally, it is noted that there are no regulated substances of very high concern. Further expanatory material may be obtained from the full comprehensive LCA report.

**Table 2: Description of the System Boundary (x: included in LCA; mnd: module not declared; mnr: module not reported)**

| Product | | | Construction Installation | | Use | | | | | | | End-of-life | | | | Benefits Beyond the System Boundary | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw Material supply | Transport | Manufacturing | Transport | Construction / Installation | Use | Maintenance | Repair | Replacement | Refurbishment | Operational Energy Use | Operational Water Use | De-Construction/ Demolition | Transport | Waste processing | Disposal | Reuse | Recovery | Recycling |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D | D | D |
| x | x | x | mnd | mnd | mnd | mnd | mnr | mnr | mnr | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd |

**Table 3. LCIA Results for 1000 kgs of Calcium Nitrate**

| Environmental Indicator | Abbreviation | Units | Total | A1 | A2 | A3 |
|---|---|---|---|---|---|---|
| ***Core Mandatory Impact Indicator*** | | | | | | |
| Global warming potential | **GWP** | kg $CO_2$-eq | 9.78E+02 | 9.20E+02 | 4.92E+01 | 8.55E+00 |
| Depletion potential of the stratospheric | **ODP** | kg CFC-11- | 2.07E-05 | 2.01E-05 | 2.05E-09 | 6.12E-07 |
| Acidification potential of land and water | **AP** | kg $SO_2$-eq | 4.08E+00 | 3.53E+00 | 5.19E-01 | 3.37E-02 |
| Eutrophication potential | **EP** | kg $PO_4$-eq | 1.05E+00 | 9.47E-01 | 3.08E-02 | 7.54E-02 |
| Formation of tropospheric ozone | **SFP** | Kg $O_3$-eq | 4.21E+01 | 2.88E+01 | 1.30E+01 | 2.17E-01 |
| Abiotic depletion potential for fossil | **ADPF** | MJ Surplus | 5.45E+03 | 4.67E+03 | 6.97E+02 | 8.43E+01 |
| Fossil Fuel Depletion | **FFD** | MJ Surplus | 5.67E+02 | 5.56E+02 | 6.36E+00 | 4.50E+00 |
| ***Use of Primary Resources*** | | | | | | |
| Renewable primary energy carrier used as energy | **RPRE** | MJ | 1.90E+02 | 1.87E+02 | 0.00E+00 | 2.15E+00 |
| Renewable primary energy carrier used as material | **RPRM** | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Non-renewable primary energy used as energy | **NRPRE** | MJ | 6.09E+03 | 5.22E+03 | 7.39E+02 | 1.36E+02 |
| Non-renewable primary energy used as material | **NRPRM** | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ***Secondary Material, Secondary Fuel and Recovered Energy*** | | | | | | |
| Use of secondary materials | **SM** | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Use of renewable secondary fuels | **RSF** | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Use of non-renewable secondary fuels | **NRSF** | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Recovered energy | **RE** | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| ***Mandatory Inventory Parameters*** | | | | | | |
| Use of freshwater resources | **FW** | $m^3$ | 3.58E+00 | 3.54E+00 | 0.00E+00 | 4.06E-02 |
| ***Indicators Describing Waste*** | | | | | | |
| Disposed of hazardous waste | **HWD** | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Disposed of non-hazardous waste | **NHWD** | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Disposed of high-level radioactive waste | **HLRW** | $m^3$ | 1.26E-07 | 9.55E-08 | 7.50E-09 | 2.29E-08 |
| Disposed of low-level radioactive waste | **LLRW** | $m^3$ | 2.30E-06 | 2.02E-06 | 7.17E-08 | 2.10E-07 |
| Components for reuse | **CRU** | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Materials for recycling | **MFR** | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Materials for energy recovery | **MER** | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Recovered energy exported | **EE** | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

## 5. Interpretation

Figure 1 shows the relative contribution to the cumulative impacts of the A1 through A3 phases of the cradle-to-gate life cycle. A1 is the largest contributor to total cradle-to-gate emissions across all the mandatory impact indicators. Therefore, the raw material supply accounts for majority of the impacts.

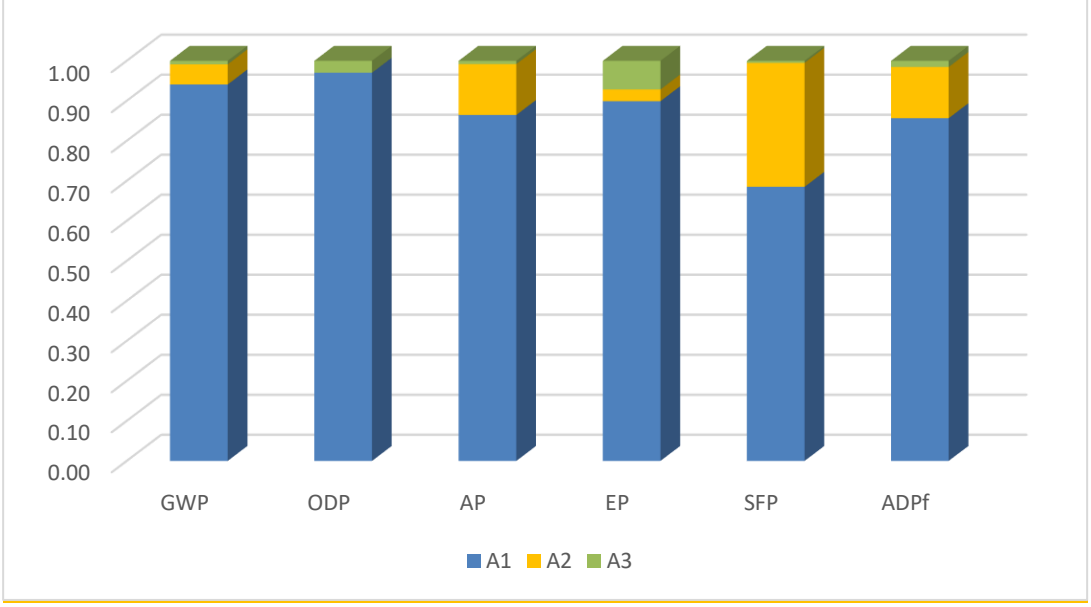


**Figure 1.** Contribution analysis for Calcium Nitrate producer by The Andersons

## 6. References

1. ASTM 2020 - ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs) General Program Instructions v8, April 29th.

2. Athena Institute: 2021 - A Cradle-to-Gate Life Cycle Assessment of Calcium Nitrate produced by The Andersons.

3. ISO 21930: 2017 Building construction – Sustainability in building construction – Environmental declaration of building products.

4. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.

5. ISO 14044:2006/AMD 1:2017/ AMD 2:2020 - Environmental management - Life cycle assessment - Requirements and guidelines.

6. 14040:2006/AMD 1:2020 - Environmental management - Life cycle assessment - Principles and framework.