

# Eco Footprint

October 2019

## Caustic Soda Microprills

Nobian uses Life Cycle Assessment (LCA) to assess and improve the environmental performance of its products in the value chain and as a basis for policy decision making.

This eco-footprint is the result of the LCA which measures human demand on nature. It presents the amount of resources needed and the amount of emissions and waste generated in order to produce a product.

The underlying LCA has been prepared according to the ISO 14025 standards for environmental product declarations.

### The product

Caustic soda microprills are the solid forms of caustic soda and are small fused pearls, color- and odorless and very hygroscopic.

The microprills are obtained from caustic soda solution by the evaporation of water. Caustic soda is produced together with chlorine and hydrogen in the electrolysis process of salt. Caustic soda and caustic soda microprills are used in many different applications, mainly as basic auxiliary in the chemical industry, for the production of aluminum, pulp and paper, surfactants like soaps, detergents, and washing powder, and as catalyst for the production of biodiesel.

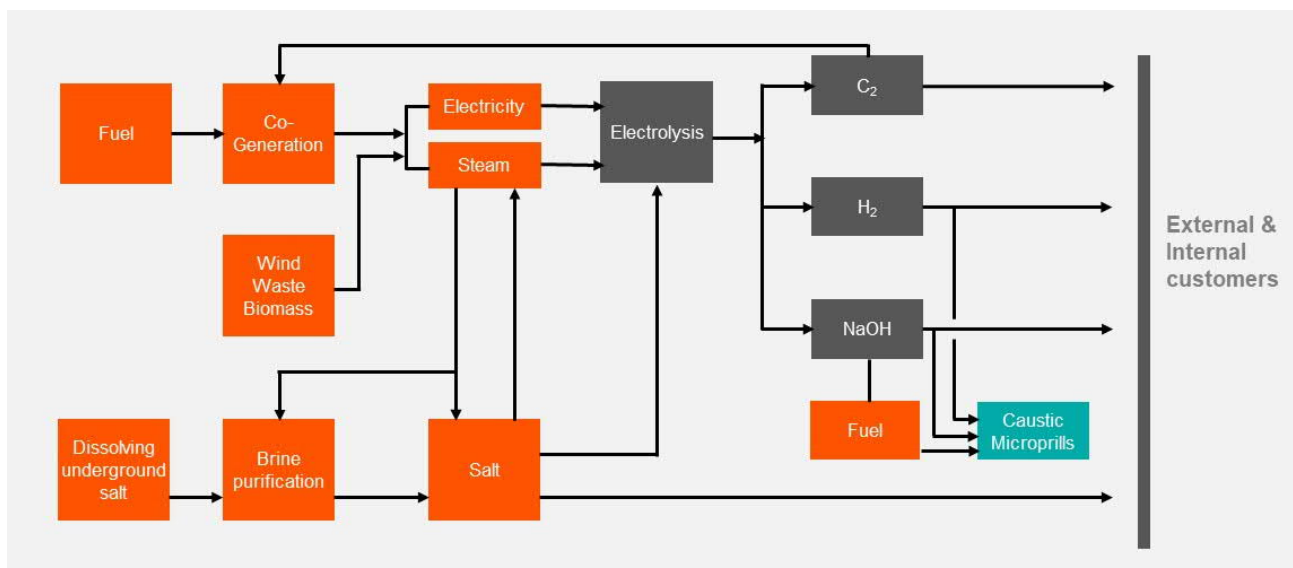
### Presentation of environmental performance

The main raw materials to produce caustic soda microprills are energy and salt. All major steps from the extraction of salt and fuels (the product's cradle), until the product leaves the gate of our plants are included in this eco-footprint. All steps in the strongly integrated production chain are depicted in the diagram below, in which caustic soda microprills is marked in green. The input of this eco-footprint is based on own production data and on the input from third parties, e.g. suppliers.

For raw materials supplied by external suppliers estimations were made if necessary.

When energy and steam are co-generated the results of the eco-footprint have been allocated based on the exergy (energy available to be used) they contain.

Caustic soda is co-produced together with chlorine and hydrogen in the electrolysis process. Resources and emissions have been allocated to these products based on the inherent mass ratio of the electrolysis process.



### About Nobian - A leader in essential chemicals

Nobian is a European leader in the production of essential chemicals for industries ranging from construction and cleaning to pharmaceuticals and water treatment. We excel in the safe and reliable supply of high-purity salt, chlor-alkali and chloromethanes, thanks to our integrated value chain with modern production sites in the Netherlands, Germany and Denmark. We have a strong heritage of salt production of over 100 years dating back to 1918. Our 1,600 employees are committed to become safer, more efficient and sustainable, to ensure that the essential products of today will keep enriching our lives tomorrow with chemistry you can count on. Nobian is wholly owned by The Carlyle Group and GIC.

## Eco-footprint results

The figures displayed in the tables below include the environmental loads from all the processes in the life cycle of caustic soda microprills cradle to factory gates, i.e. extraction of natural resources, raw material production, energy production and transportation. All figures are given for 1 metric ton of caustic soda (NaOH 100%) prills

### Resources

Non-renewable	MJ	kg	Renewable	MJ	kg
Crude oil	1.04E+03		Total Energy	1.88E+02	
Natural gas	9.02E+03		Water		*
Uranium	2.02E+03				
Coal	8.31E+03				
Salt		8.93E+02			

*This table displays the total use of non-renewable and renewable resources, with and without energy, including feedstock, needed for 1 metric ton of caustic soda microprills.*

*\* Water is used as resource for production, formulation and cooling. Most of it is returned to the original water body. Nobian assesses its water use for all production sites with an internal water management tool. The water use of the caustic soda microprills production sites has been assessed to be sustainable.*

Some emissions relate to environmental impacts like climate change, ozone depletion, acidification, photochemical ozone creation and eutrophication. The impact on those categories is presented below. Over the past 7 years Nobian Industrial Chemicals has reduced by various projects the carbon footprint (GWP) for caustic soda microprills with 13%.

### Emissions, expressed in terms of environmental impact

Category of impact	Equivalent unit	Impact
Global warming potential (GWP)	kg CO <sub>2</sub>	1.07E+03
Ozone depletion potential (ODP)	kg CFC-11	4.17E-05
Acidification potential (AP)	kg SO <sub>2</sub>	2.05E+00
Photochemical ozone creation potential (POCP)	kg Ethene	1.57E-01
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup>	1.48E+00

*An explanation to these impact categories can be found in the right column.*

The most important air and water emissions are given in the tables below.

Emissions	To air	To water
	kg	kg
Carbon dioxide	1.02E+03	
Non Methane VOC	2.39E-01	
Nitrogen dioxide	1.55E-01	
Sulfur dioxide	8.44E-01	
Mercury	1.62E-05	9.70E-05
Chloride		4.72E+00
Sulfate		8.20E-01

*Major and most significant emissions to air and water.*

Waste generation [kg]	Upstream process	Core process
Non-hazardous	Not avail.	3.47E-01
Hazardous	Not avail.	8.08E-02

*Different types of waste are divided into the two groups displayed above.*

*Aggregated waste items were allocated to process steps, so that the amount of waste is related to 1 metric ton of caustic soda microprills. 97% of the non-hazardous waste is re-useable, while none of the hazardous waste is.*

## Glossary

**Acidification** Chemical alteration of the environment, resulting in hydrogen ions being produced more rapidly than they are dispersed or neutralized. Occurs mainly through fallout of sulfur and nitrogen compounds from combustion processes. Acidification can be harmful to terrestrial and aquatic life.

**Carbon footprint** reflects the impact of an activity on climate change due to the greenhouse gases emitted. It is expressed as global warming potential.

**Chemical oxygen demand, COD**, used to indirectly measure the amount of organic compounds in water.

**Eutrophication** Enrichment of bodies of water by nitrates and phosphates from organic material or the surface runoff. This increases the growth of aquatic plants and can produce alga blooms that deoxygenate water and smother other aquatic life.

**Environmental product declaration, EPD**, is defined as "quantified environmental data for a product with pre-set categories of parameters based on the ISO 14040 series of standards, but not excluding additional environmental information".  
www.environdec.com

**Global warming potential, GWP**, the index used to translate the level of emissions of various gases into a common measure to compare their contributions to the absorption by the atmosphere of infrared radiation.

**Life Cycle Assessment, LCA**, A method for appraising and quantifying the total environmental impact of products or services over their entire life cycle (from extraction of natural resources to final waste management), based on ISO 14040-14043

**Ozone depletion potential, ODP**, the index used to translate the level of emissions of various substances into a common measure to compare their contributions to the breakdown of the ozone layer

**Photochemical ozone creation potential, POCP**, the index used to translate the level of emissions of various gases into a common measure to compare their contributions to the change of ground-level ozone concentration.

**Primary Energy** is the amount of energy needed directly from nature for the life-cycle part from cradle to gate. It is expressed as the energy contained in the natural energy carrier (e.g. crude oil or biomass) before it has been converted to usable energy, such as fuel or electricity, and applies to both non-renewable and renewable energy.

**Waste.** Due to large uncertainties in the numbers for waste in upstream production, only the amounts for the Nobian core process are presented.