Certified Environmental Product Declaration (EPD) for Sodium chlorate ($NaClO_3$)

Description of the product and the company

The product

Sodium chlorate ($NaClO_3$) is an efficient oxidising agent. Sodium chlorate from Eka Chemicals is supplied to customers in crystalline form and delivered by tanker trucks, rail tank cars or tank containers containing up to 60 ton. Delivery can also be made in “big-bags” containing approximately 1000 kg.

Sodium chlorate is produced by electrolysis of a salt solution. The raw materials are sodium chloride (NaCl), water and electrical power. Sodium chlorate and hydrogen gas (H_2) are formed in the process. Hydrogen can be used as a chemical raw material (for hydration, manufacturing of hydrogen peroxide etc.) or as a fuel. The solution formed is crystallised and the chlorate crystals are separated, washed and dried. The manufacturing of sodium chlorate takes place in Stockvik and Alby, Sweden and in Mo i Rana, Norway.

The functional unit in this study is 1000 kg of sodium chlorate. This means that the environmental load presented is valid for 1000 kg of sodium chlorate. The displayed figures are given as an average for Eka Chemicals production in Sweden and Norway. The average is weighted according to production volumes from the plants.

Sodium chlorate from Eka Chemicals contains ≥99,5% sodium chlorate. Sodium chlorate is classified and labelled oxidising and harmful.

Table 1 Declaration of content and labelling

	Category of danger	Symbol letters	Risk phrases
Sodium chlorate	Oxidising; Harmful	O; Xn	R9; R22
R9: Explosive when mixed with combustible material *R22: Harmful if swallowed*			

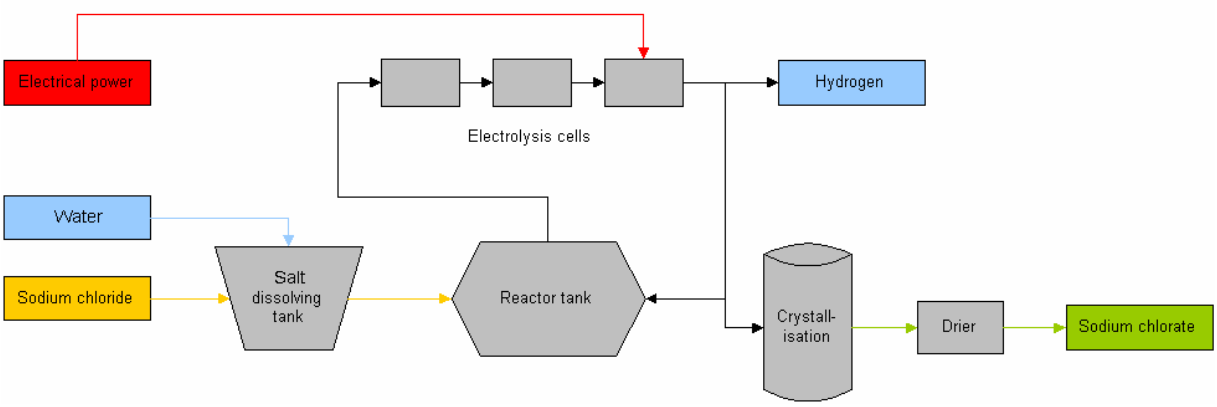

Figure 1 Manufacturing of sodium chlorate

The company

Akzo Nobel serves customers throughout the world with healthcare products, coatings, and chemicals. Akzo Nobel run operations in 80 countries and has about 70,000 employees.

Eka Chemicals, who manufactures sodium chlorate, is a Business Unit within Akzo Nobel and has 3000 employees in 30 countries. The headquarters are located in Bohus, just north of Gothenburg, Sweden. Eka Chemicals is a supplier of chemicals for pulp bleaching processes and paper manufacturing but also markets chemicals for certain speciality applications as well as fine chemicals.

Presentation of environmental performance

All major steps from the extraction of natural resources until the products leave the gates in Alby, Stockvik and Mo i Rana are included in the environmental performance of the manufacturing phase. A few of these are displayed in the simplified flowchart below.

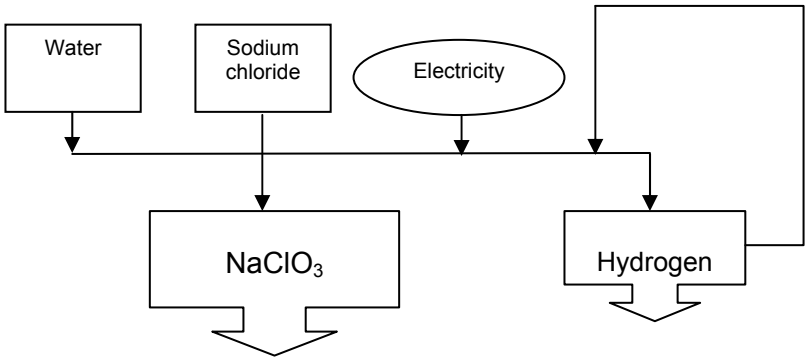

Figure 2 Flowchart for production of sodium chlorate

The used data were collected for year 2000 and others are said to be valid for that time according to suppliers. Site-specific data have been retrieved for all major raw materials or have been guaranteed to correspond with site-specific data according to suppliers.

In this study economical allocation has been the base for calculations, meaning the environmental load from a production has been divided according to economical value of the products produced. Besides sodium chlorate, hydrogen and heat are produced in the manufacturing process of sodium chlorate. The environmental load is cost allocated between sold hydrogen, sold heat and sodium chlorate.

The manufacturing phase

The figures displayed below cover not only the environmental load derived from the production site of sodium chlorate. All other steps during the life cycle up until the product leaves the gates in Alby, Stockvik and Mo i Rana are included like natural resource extraction, raw material production, energy production and transportation. All figures are given for 1000 kg of sodium chlorate.

Table 2 Non renewable resources

Without energy content	kg	With energy content	MJ
Sodium chloride	580	Nuclear energy	22000
Copper ore	5	Natural gas	1100
Limestone	5	Crude oil	350
		Coal	70
		Hydrogen	30

This table displays the total use of non renewable resources, including feedstock, needed for 1000 kg sodium chlorate

Table 3 Renewable resources

Without energy content	kg	With energy content	MJ
-	-	Hydro energy	15000
		Biomass	140
		Wind energy	5

Due to reasons of economical confidentiality the net electricity consumption cannot be declared. This has been approved by the Swedish Environmental Council.

Table 4 Electricity sources

Electricity production source	%
Hydro power	60
Nuclear power	40
Natural gas	<0,1
Biofuel	<0,1
Coal	<0,01
Unspecified	<0,01

Unspecified means that the electricity grid is not known and is represented by a mix of electricity production sources..

Note that energy is not the same as electricity. For example nuclear energy is a measure of the total energy content in the uranium fuel in the same way as crude oil is a measure of energy content. Hence nuclear energy is not the same as nuclear electricity (here named Nuclear power), like crude oil is not the same as electricity produced from oil.

In accordance with the guidelines for EPDs, the most important air and water emissions are expressed both as inventory data and as influence on different environmental impact categories. The result is displayed below.

Table 5 Emissions to air

Emissions to air	g
CO_2	84000
Hydrogen	14000
NOx	700
SO_2	200
CO	90
Particles	90
HC	60
CH_4	50
$NaClO_3$	9
Hg	0,003

Table 6 Emissions to water

Emissions to water	g
NaCl	5500
$CaCl_2$	1200
NaClO	60
$NaClO_3$	60
COD	5
N total	2
Cr^{6+}	0,08
Hg	4,6E-05

Table 7 Waste generation

Waste	kg
Other waste	330
Hazardous waste	0,1

Table 8 Emissions, expressed in terms of environmental impact

Category of impact	Equivalent unit	Impact
Global warming (GWP)	g CO_2	86000
Acidification (AP)	mole H^+	20
Ozone depletion (ODP)	g CFC-11	0,05
Photochemical ozone creation (POCP)	g ethene	20
Eutrophication (EP)	g O_2	4200

An explanation of these impact categories is found at the end of this EPD.

Some of the emissions presented as special parameters have indexes in the different impact categories and are therefore influencing them. The environmental flows shown are in some cases demanded by the Product-Specific Requirements (PSR) for chemical products. In other cases they are displayed because they are considered to be significant for the production of sodium chlorate.

The use phase

Sodium chlorate ($NaClO_3$) from Eka Chemicals is mainly used at pulp mills in the production of chlorine dioxide used for ECF-bleaching of chemical pulp. The product is not considered to contribute to an increased environmental load during the use phase and its major decomposition products are sodium ions and chloride ions.

The environmental impact from the transport to customer is given for the transport of 1000 kg of sodium chlorate, 100 km for the means of transport in question. This makes it possible for customers to assess the environmental load derived from transportation of sodium chlorate. The actual means used depend on where the customer is situated. Some times all three means are used.

Table 9 Envrionmental impact from transport to customer

Impact	Unit	Train[1]	Truck[2]	Ship[3]
Crude oil	MJ	-	91	22
Hydro energy	MJ	23	-	-
CO_2	g	0,4	6720	1540
CO	g	0,01	6	0,9
HC	g	0,001	6	2
NOx	g	0,001	42	43
SO_2	g	0,0006	1,4	26
Particles	g	0,0001	0,7	2

The means of transport are approximated with a train transport, a truck transport and a ship transport.

1. *The train is a Swedish electric train.*
2. *The truck has a maximum weight of 60 ton, a Euro III engine and is using EC1-diesel. The loading factor is 50%.*
3. *The ship has a maximum weight of more than 8000 ton and a loading factor of 50-60%.*

Information from the company and the accredited certification body

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Information from the accredited certification body

This Environmental Product Declaration has been reviewed and approved by an accredited certification body - the Swedish National Testing and Research Institute (SP) - according to the Product-Specific Requirement, PSR 2000:5 for Chemical Products and the Swedish Environmental Council requirements for environmental product declarations, MSR 1999:2.
Valid until: August 30, 2005
Registration number: S-P-00030

SP, Box 857, SE-501 15 Borås, Sweden
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Other information

More information about environmental product declarations - the EPD system – can be found on the Internet: http://www.environdec.com

References

- LCA documentation for sodium chlorate, 2002
- Product-Specific Requirements Chemical Products, (PSR 2000:5)
- Requirements for Environmental Product Declarations, EPD (MSR 1999:2) – an application of ISO TR 14025.

Glossary

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

Eutrophication potential, EP. 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.

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. GWPs are calculated as the absorption that would result from the emission of 1 kg of a gas to that from emission of 1 kg of carbon dioxide over 100 years.

Life Cycle Assessment, LCA.. A management tool for appraising and quantifying the total environment impact of products or activities over their entire life cycle of particular materials, processes, products, technologies, services or activities.

Ozone depletion potential, ODP. The index used to translate the level of emissions of various substances into a common measure to compare their contributes to the breakdown of the ozone layer. ODPs are calculated as the change that would result from the emission of 1 kg of a substance to that from emission of 1 kg of CFC-11 (a freon)

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. POCPs are calculated as the change that would result from the emission of 1 kg of a gas to that from emission of 1 kg of ethene.