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CONTENTS

AVERY® READY INDEX® DIVIDERS

TAB 1

SQM

NORTH AMERICA

February 25, 2005

Mr. Robert Pooler
Agricultural Marketing Specialist
USDA/AMS/TM/NOP
Room 2510-So., Ag Stop 0268
P.O. Box 94656
Washington, D.C. 20090-6456

Dear Mr. Pooler:

On behalf of SQM North America, I am presenting this petition for the continued usage of non-synthetic Natural Sodium Nitrate in USDA Certified Organic crop production in The United States of America. Our product is necessary for our growers to maintain their economic viability; furthermore, this product is agronomically and environmentally sound and adheres to the principles of organic crop production. Natural Sodium Nitrate is permitted as a source of nitrogen for USDA Certified organic crops grown and used in The United States of America and this petition seeks to continue its usage.

We look forward to the continued usage of Natural Sodium Nitrate and appreciate your attention to this petition.

If you have any questions, please contact me.

Sincerely,

Bill McBride

Bill McBride
Director
Sales U.S. and Canada

bmcbride@mindspring.com or bill.mcbride@yara.com

404-664-4022 or 813-222-5734

SQM NORTH AMERICA CORP.
3101 Towercreek Parkway, Suite 450
Atlanta, GA 30339
Tel: (1 - 770) 916 9400
Fax: (1 - 770) 916 9454
www.sqm.com

USDA

United States Department of Agriculture

Agricultural Marketing Service

STOP 0268 – Room 4008-S
1400 Independence Avenue, SW.
Washington, D.C. 20250-0200

February 9, 2005

Bill McBride
SQM North America, Corp.
3101 Towercreek Parkway
Suite 450
Atlanta, GA 30339

Dear Mr. McBride:

Thank you for your petition of February 8, 2005, which requests the continued allowance of natural sodium nitrate in organic crop production.

We have reviewed your petition and determined that further information is needed before the National Organic Program can declare that all information requested has been supplied. As a part of filing a petition to amend the National List, there is specific information that must be supplied according to 65 FR 43259 (http://www.ams.usda.gov/nop/NationalList/PetitionProcess.html). We request that you amend your petition by supplying the requested information as noted in the attached checklist. If you should have any questions, please contact us as soon as possible by phone at (202) 702-3252 or email at Arthur.Neal@usda.gov.

Sincerely,

Arthur Neal
Agricultural Marketing Specialist
USDA National Organic Program

cc: NOSB Materials Committee

ATTACHMENT: INFORMATION TO BE INCLUDED IN A PETITION

ITEM A

Please indicate within which of the following categories your substance is being petitioned for inclusion on or removal from the National List:

- Synthetic substance's allowed for use in organic crop production;
- Nonsynthetic substances prohibited for use in organic crop production;
- Synthetic substances allowed for use in organic livestock production;
- Nonsynthetic substances prohibited for use in organic livestock production; and
- Nonagricultural (nonorganic) substances allowed in or on processed products labeled as ``organic" or ``made with organic (specified ingredients)."

ITEM B

1. The substance`s common name.
2. The manufacturer's name, address and telephone number.
3. The intended or current use of the substance such as use as a pesticide, animal feed additive, processing aid, nonagricultural ingredient, sanitizer or disinfectant.
4. A list of the crop, livestock or handling activities for which the substance will be used. If used for crops or livestock, the substance's rate and method of application must be described. If used for handling (including processing), the substance`s mode of action must be described.
5. The source of the substance and a detailed description of its manufacturing or processing procedures from the basic component(s) to the final product. Petitioners with concerns for confidential business information can follow the guidelines in the Instructions for Submitting Confidential Business Information (CBI) listed in #13.
6. A summary of any available previous reviews by State or private certification programs or other organizations of the petitioned substance.
7. Information regarding EPA, FDA, and State regulatory authority registrations, including registration numbers.
8. The Chemical Abstract Service (CAS) number or other product numbers of the substance and labels of products that contains the petitioned substance.
9. The substance's physical properties and chemical mode of action including (a) chemical interactions with other substances, especially substances used in organic production; (b) toxicity and environmental persistence; (c) environmental impacts from its use or manufacture; (d) effects on human health; and, (e) effects on soil organisms, crops, or livestock.
10. Safety information about the substance including a Material Safety Data Sheet (MSDS) and a substance report from the National Institute of Environmental Health Studies.
11. Research information about the substance which includes comprehensive substance research reviews and research bibliographies, including reviews and bibliographies which present contrasting positions to those presented by the petitioner in supporting the substance's inclusion on or removal from the National List.
12. A ``Petition Justification Statement" which provides justification for one of the following actions requested in the petition:

- When petitioning for the inclusion of a synthetic substance on the National List, the petition should state why the synthetic substance is necessary for the production or handling of an organic product. The petition should also describe the nonsynthetic substances or alternative cultural methods that could be used in place of the petitioned synthetic substance. Additionally, the petition should summarize the beneficial effects to the environment, human health, or farm ecosystem from use of the synthetic substance that support the use of it instead of the use of a nonsynthetic substance or alternative cultural methods.

- When petitioning for the removal of a synthetic substance from the National List the petition must state why the synthetic substance is no longer necessary or appropriate for the production or handling of an organic product.

- When petitioning for the inclusion on the National List of a nonsynthetic or nonagricultural substance as a prohibited substance the petition must state why the nonsynthetic or nonagricultural substance should not be permitted in the production or handling of an organic product.

- When petitioning for the removal from the National List of a nonsynthetic or nonagricultural substance as a prohibited substance the petition must state why the nonsynthetic or nonagricultural substance should be permitted in the production or handling of an organic product.

ITEM B - CONTINUED....

13. A Commercial Confidential Information Statement which describes the specific required information contained in the petition that is considered to be Confidential Business Information (CBI) or confidential commercial information and the basis for that determination. Petitioners should limit their submission of confidential information to that needed to address the areas for which this notice requests information. Instructions for submitting CBI to the National List Petition process are presented in the instructions below:

(a) Financial or commercial information the applicant does not want disclosed for competitive reasons can be claimed as CBI. Applicants must submit a written justification to support each claim.
(b) ``Trade secrets" (information relating to the production process, such as formulas, processes, quality control tests and data, and research methodology) may be claimed as CBI. This information must be (1) commercially valuable, (2) used in the applicant's business, and (3) maintained in secrecy.
(c) Each page containing CBI material must have ``CBI Copy" marked in the upper right corner of the page. In the right margin, mark the CBI information with a bracket and ``CBI."
(d) The CBI-deleted copy should be a facsimile of the CBI copy, except for spaces occurring in the text where CBI has been deleted. Be sure that the CBI-deleted copy is paginated the same as the CBI copy. (The CBI-deleted copy of the application should be made from the same copy of the application which originally contained CBI.) Additional material (transitions, paraphrasing, or generic substitutions, etc.) should not be included in the CBI-deleted copy.
(e) Each page with CBI-deletions should be marked ``CBI-deleted" at the upper right corner of the page. In the right margin, mark the place where the CBI material has been deleted with a bracket and ``CBI- deleted."
(f) If several pages are CBI-deleted, a single page designating the numbers of deleted pages may be substituted for blank pages. (For example, ``pages 7 through 10 have been CBI-deleted.")
(g) All published references that appear in the CBI copy should be included in the reference list of the CBI-deleted copy. Published information usually cannot be claimed as confidential.

However, the National List substance evaluations will involve a public and open process. Nonconfidential information will be available for public inspection.

The NOP Program Manager may request additional information from the petitioner following receipt of the petition.

Source: "Notice of Guidelines and Call for National List Petitions: What Information Has to be Included in the Petition?" *Federal Register* 60:135 (13 July 2000) p. 43260-43261.

TAB 2

PETITION : EVALUATION OF NATURAL SODIUM NITRATE (ALSO SOMETIMES CALLED CHILEAN NITRATE) AGAINST CRITERIA FOR SUBSTANCES ADDED TO THE NATIONAL LIST

ITEM A

The product is being petitioned for the following categories for inclusion on the National List:
☒ *Currently allowed nonsynthetic substance under review in 2005.*

ITEM B

1. The substance`s common name :
Natural Sodium Nitrate (also referred to as Chilean Nitrate)
Branded as "Allganic Nitrogen"

2. The manufacturer`s name, address and telephone number :
SQM North America
3101 Towercreek Parkway Suite 450
Atlanta, Georgia 30339
Ph. (770) 916 - 9416
Fax (770) 916 - 9401

3. The intended or current use of the substance :
Nitrogen (fertilizer) amendment and soil improver for organic crop production

4. Description; compositional requirements; conditions of use :
Product obtained from nitrogenous rock through physical processes using mostly solar energy and without synthetic additives. To be used as a complement to the organic sources of nitrogen and according to local conditions. Should be certified by the authority or certification body. (ALINORM 04/27/22, APPENDIX VII, ANNEX 2)

5. The source of the substance and a detailed description of its manufacturing or processing procedures: *Natural Way of Production of Chilean Nitrate .*

5.1. Location of the Natural Chilean Nitrogenous rock

Natural Chilean Nitrate is mined from natural deposits of "caliche". The nitrate ore, "caliche", is found in the Tarapacá and Antofagasta regions, where the extremely arid Chilean desert is located, in a discontinuous strip on the eastern slopes of the pacific coastal range between the latitudes of 19° and 26° (Figure 1).

The lack of moisture has prevented the weathering of the surface rocks (parent material) and the development of living organisms (microbial, vegetal, animal, human) two main factors in the process of soil formation and as a direct consequence, no soil development process has ever occurred in the Atacama Desert.

The age and aridity of the Atacama Desert are probably directly responsible for the large nitrate accumulations that are present there. The nitrates are likely to be of atmospheric origin (Ericksen, 1981).

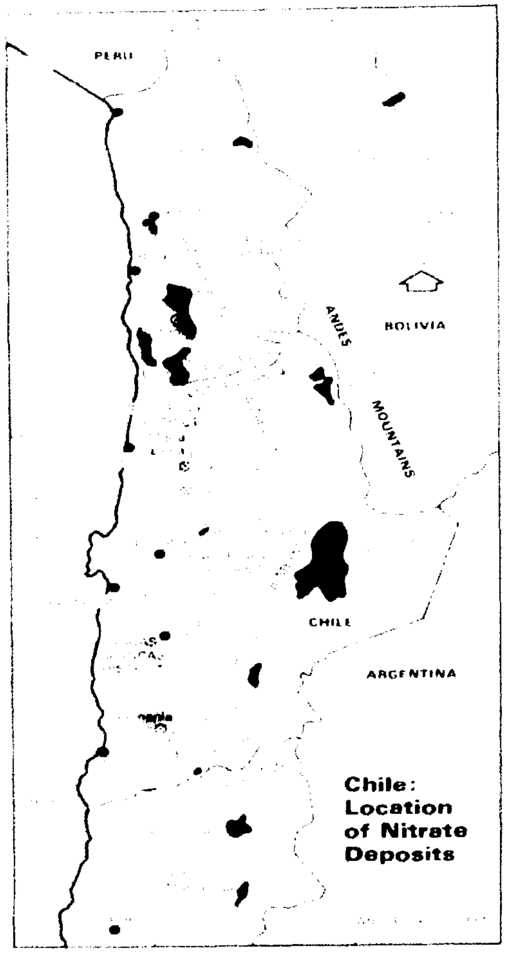

Figure 1: Location of nitrogenous rock (Ericksen, 1981)

5.2. Description of the Natural Chilean Nitrogenous rock

The deposits or "Caliche" occur in all types of rock and unconsolidated sediments without showing any systematic variation in mineral content. 98% of the nitrate (saltpeter) deposits are found under the formation of layers or strata. A succession of layers of varied thickness forms the nitrate (saltpeter) deposits.

Most widespread are the unconsolidated regolith, conglomerates of insoluble and barren material cemented by soluble oxidized salts; predominantly sulphates, nitrates and chlorides of Na, K and Mg. Caliche does contain significant quantities of borates, chromates, chlorates and iodates. Apart from this, Natural Chilean Nitrate derived from caliche contains different trace, or minor, elements including iodine, copper, zinc, boron and molybdenum.

Table 1: Some of the common saline minerals present in the caliche deposits (after Garret, 1983)

Halides		***Formula***	***Approved for organic farming (reference, FIbl)***
	Halite	$NaCl$	*approved*
Nitrates			
	Soda niter	$NaNO_3$	*Under review*
Borates			
	Ulexite	$NaCaB_5O_9.8H_2O$	*very close to approved Na-borate mineral (Borax) but less soluble*
	Proberite	$NaCaB_5O_9.5H_2O$	*very close to approved Na-borate mineral (Borax) but less soluble*
	Hydroboracite	$CaMgB_6O_{11}.6H_2O$	*very close to approved Na-borate mineral (Borax) but less soluble*
	Colemanite	$Ca_2B_6O_{11}.5H_2O$	*very close to approved Na-borate mineral (Borax) but less soluble*
Sulphates			
	Thenardite	Na_2SO_4	*approved*
	Kieserite	$MgSO_4.H_2O$	*approved*
	Epsomite	$MgSO_4.7H_2O$	*approved*
	Gypsum	$CaSO_4.2H_2O$	*approved*
	Anhydrite	$CaSO_4$	*very similar to approved product* $CaSO_4.2H_2O$
	Bassanite	$2CaSO_4.H_2O$	*very similar to approved product* $CaSO_4.2H_2O$

As one can observe from Table 1 many minerals present in caliche are as such already allowed in organic agriculture or at least very closely related to allowed substances.

In Table 2 a typical analysis of currently mined Caliche is presented.

Table 2: Caliche analysis (Garret, 1983)

Pure Caliche	***Analysis Currently mined***
$NaNO_3$	*6-10 wt%*
Na_2SO_4	*6-15 wt%*
$NaCl$	*6-10 wt%*
K	*0.4-1.0 wt%*
Mg	*0.2-0.8 wt %*
Ca	*1.0-1.25 wt %*
IO_3	*0.04-0.08 wt %*
B_4O_7	*0.3-1.0 wt %*
H_2O	*1.1-2.0 wt %*

5.3. Geological origin

There are several theories on the formation and origin of the natural nitrogenous rock (Mueller, 1968). Almost all of them are based on bacterial mineralization:

① *Production of nitrate through bacterial decay and action of nitrifying bacteria on organic matter of plant and animal remains;*
② *Leaching of guano on the margins of saline lakes inland arms of the sea, or salars.*
③ *Nitrification and fixation of atmospheric nitrogen by bacteria in the soil.*
④ *Deposition of atmospheric saline materials at or near the sites of the deposits*

Their discussion is beyond the scope of this document and the interested reader is referred to Ericksen, G.E. (1981) for a presentation of his own investigations and a well documented discussion of the subject.

Nevertheless, it should be noted that the single most important factor in the accumulation of saline materials in the Atacama Desert has been the extreme aridity of the region which has existed for 10 - 15 million years. But although the climate of the Atacama Desert has been extremely arid throughout late Tertiary and Quaternary time, there have been intervals of climatic change when increasing rainfall greatly modified or destroyed preexisting nitrogenous rock deposits. According to Ericksen G.E. (1981), if the nitrogenous rock deposits were formed during the past 10 – 15 million years and if they have a complex history of repeated deposition and destruction, a rate of deposition whereby the nitrate might accumulate in 200.000 years is reasonable. That would be an estimated theoretical period of time for the formation of the present day deposits, with the added implication that no rainfall with nitrate leaching capacity has occurred during that period.

The nitrogenous rock occurs on a high plateau with essentially zero rainfall (< 2 mm precip. yr^{1}), bordered on the east by the high Cordillera of the Andes and on the west by the Pacific coastal range, both these areas catch what little rainfall is available. The high mountain area has about 150 mm yr^{-1} of rain and the coastal range between 10 and 30 mm yr^{-1}.
Nitrate rich soils occur locally in other deserts of the world but are nowhere as widespread as those found in the Atacama Desert.

5.4. History of Usage

Natural Chilean Nitrate is probably the oldest single nitrogen fertilizer. There is evidence that the pre-Inca culture of the Atacamenos employed high grade ores as a fertilizer in the 7^{th} and 8^{th} century. Tradition ascribes the rediscovery of the fertilizer properties of caliche, in the 17^{th} century, to a priest who was brought "dirt that burns", by the Indians for analysis, and who then threw the remains onto his garden. Prior to 1800, the extraction of saltpeter from caliche was performed by leaching ore in animal skins with cold water. The resultant solution was run into copper pots and concentrated.
In 1805 Tadeaus Haenke, a German naturalist living in Bolivia first identified that the principal nitrate in caliche was the sodium salt.

Figure 2: Mining of Natural Chilean Nitrate at the beginning of the century

He developed a process to concentrate and retrieve the nitrates from the ore. Around 1880 when Darwin visited the small nitrate plants called "paradas" he reported the existence of iodine in the caliche. After discovery of the Bosh-Haber ammonia process and the world depression reduced the fertilizer prices the Chilean nitrate was replaced in great extend.

5.5. Mining, production process and disposal does not result in, or contribute to harmful effects on the environment

5.5.1. Mining method and ore preparation

The lack of moisture is a critical condition that has permitted the Chilean nitrate to remain in the superficial caliche layer of the desert for more than 200,000 years without a trace of leaching (Ericksen, 1981).

The caliche is mined in open pit areas. Based on general exploration on square grids, areas are laid out and combined to reach and average grade. After blasting and removing the overburden, the caliche is mined. Then the caliche is crushed over 3 stages until the size reached is about 8 mm.

Figure 3: Close-up view of caliche rock

5.5.2. Extraction process and crystallization

Only nitrate ore (caliche) is needed to produce sodium nitrate of natural origin (IFDC and UNIDO, 1998. Fertilizer Manual, p. 238). This is in sharp contrast with all potassium and magnesium sulphate fertilizers allowed in organic agriculture.

The Caliche is grounded to a size of 1.0 centimeter and between 75 and 80% of the tonnage reduced to this size is deposited in large 10,000 m^3 capacity lixiviating vats. The fine residue from the grounding process is sent to a different leaching system, where iodine is recuperated.

Warm 48 °C "weak mother solutions" are circulated through the Caliche particles in the vats, until the solution is saturated in sodium nitrate becoming a "strong mother solution". The strong solution is cooled to 12°C in order to crystallize and precipitate the dissolved sodium nitrate. After recovering dissolved iodine at the iodine plant, the resulting "weak mother solution" is sent back to the leaching vats to a new cycle in the close leaching-precipitation circuit. In the close leaching circuit water may be lost only by evaporation.

New fresh water is not used in the leaching cycle, except when is needed to displace the "strong mother solution" from the refuse. Due to limitations in the quantity of water used to wash the refuse and since this limited volume is not fully efficient in displacing all the "strong solution" the retrieval of the sodium nitrate from the Caliche is only about 75%.

The crystallized sodium nitrate is centrifuged and prilled, being ready to be used as a source of natural nitrate nitrogen in crop production.

5.5.3. Solar Evaporation System.

Through the cooling and centrifugation process, only sodium nitrate and iodine can be recuperated from the Caliche ore. However, the Solar Evaporation System (SES) permits the retrieval of additional nitrate and other salts from the "weak mother solution" before it is recycled to the leaching vats. The SES is also used to concentrate solutions produced by "heap leaching" of old refuse piles of caliche ore, that was processed many years ago to extract Natural Nitrate using less efficient processes.

The operation of the SES begins by adding additional water to the refuse wash in the leaching vats. The water not only displaces additional sodium nitrate that otherwise goes with the refuse, but it also dissolves potassium double salts, borates, iodine, sulfates, magnesium salts and others, which are only partly soluble in the "strong mother solution". After passing through the normal cooling-crystallization stage the new strong solutions are not sent back to the leaching vats to start a new cycle, but instead they are pumped to the Solar Evaporation System to be concentrated.

The Solar Evaporation System consist of a series of interconnected ponds where the solution moves from a first pond having the initial or lowest salt concentration up to the last pond with the highest salt concentration that can be attained through solar evaporation. After reaching the predetermined optimum salt concentration, the Natural Nitrate is recovered from the solutions by cooling and crystallization, and the final weak solution is sent to the vats to start a new leaching cycle of caliche ore.

There are two Solar Evaporation Plants, Coya Sur and Pampa Blanca, with 640,000 m^2 and 544,000 m^2 of pond evaporating surface, respectively. The average daily evaporation rate for the whole year at each plant is 4. 5 L m^{-2} and 3 L m^{-2}, respectively, this being another consequence of the permanent dry conditions in the Atacama Desert. The total volume of water evaporated from the solar ponds is over 1.5 million cubic meters per year, equivalent to more than one million kWh (kilowatt-hour) per year of solar energy captured by the system.

The total energy input (mostly for rock crushing, ore conveying and evaporation) is 44GJ per ton of N of which 57% comes from directly captured solar energy i.e. at 19 GJ per ton N total non renewable energy, its energy score is much more favorable than for synthetic N fertilizer that consumes on average 40 GJ per ton N non-renewable energy (SQM, 2004; EFMA, 2002).

The Natural Nitrate is not only a natural product but the majority of the energy used in the extraction process is renewable solar energy.

Figure 4: View of the Atacama Desert

Figure 5: Caliche sampling and mining preparation

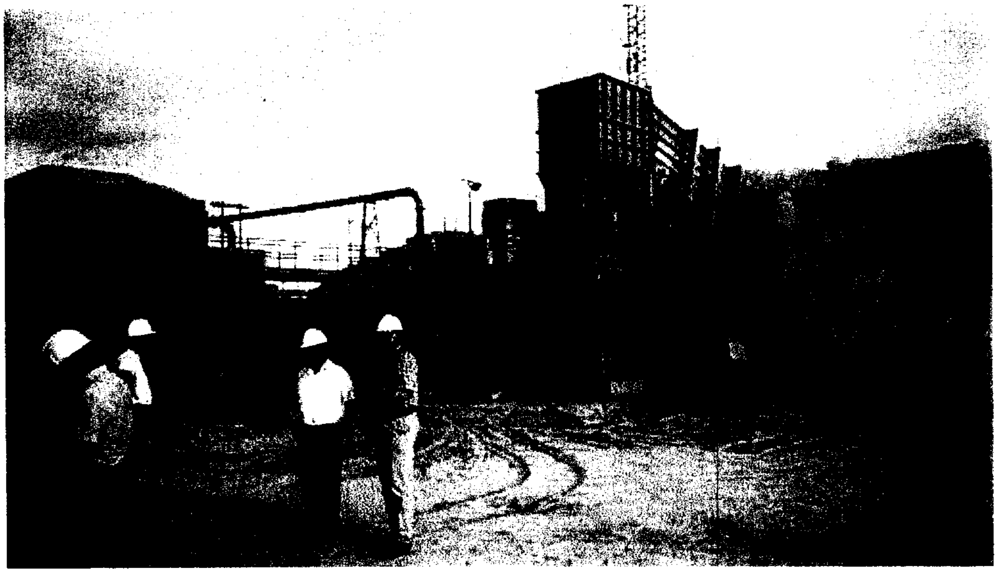

Figure 6: Crushing of the caliche rock before nitrate extraction

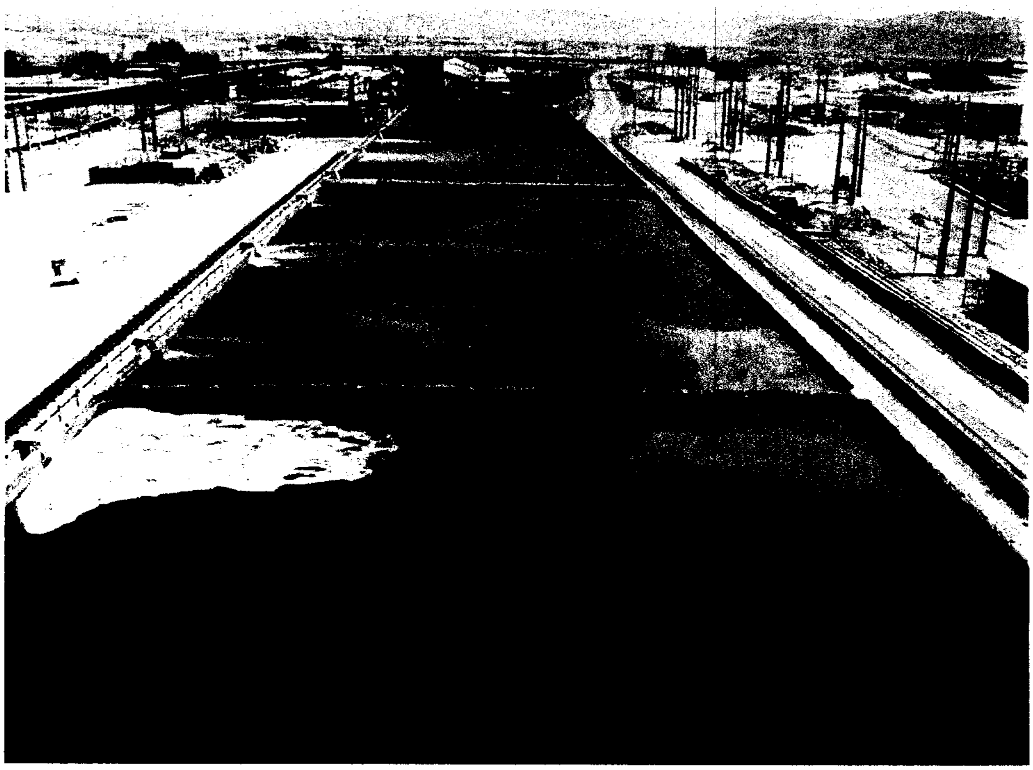

Figure 7: Closed counter current extraction vats

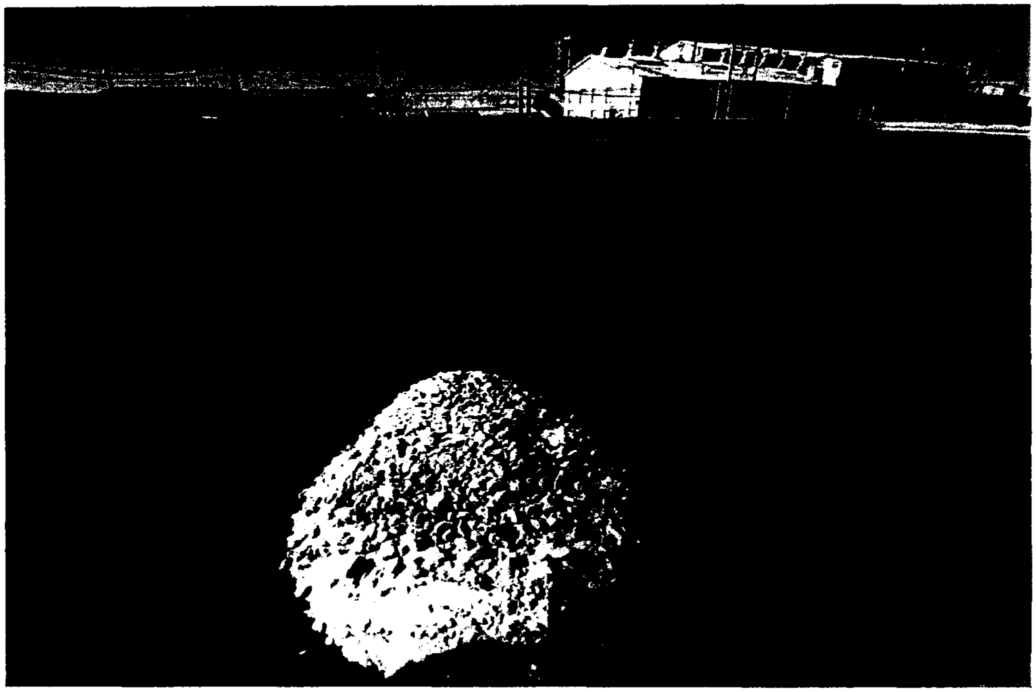

Figure 8: Inside view of the extraction vats

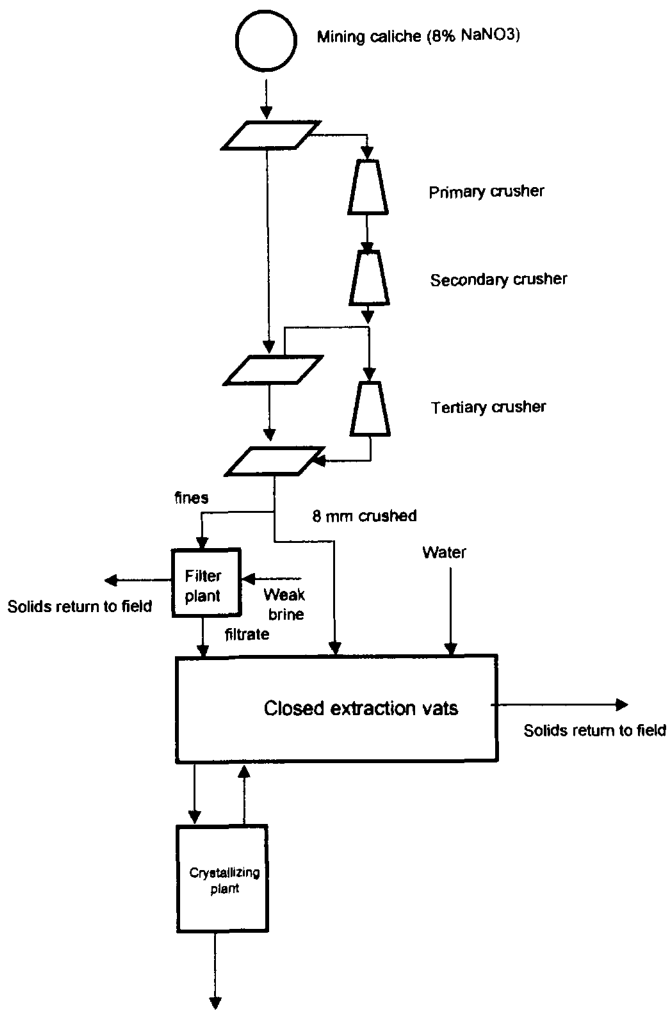

Figure 9: Flow process diagram of the recovery of natural nitrates from caliche

Table 3: Mineral content of Natural Chilean Nitrate as finished product

Mineral content		
	%	ppm
N	16	
Na	26	
I		50-150
B		300-800
Ca		20-50
Fe		20-40
Cu		20-60
Zn		40-80
Mg		500-1500
Mn		300-700
S		1500-3000
SiO2		10-30

5.5.4. Ore reserves/sustainability

Natural Chilean Nitrate is found principally in a large ore body nearly 800km long and 15 to 25kg wide. Small deposits occur in other areas, e.g. Africa, Australia, Mexico and China (IFDC & UNIDO, 1998. Fertilizer Manuel, p. 239). Mining has been taking place for over 100 years and according to the mining company, at current output it will last for several more centuries. The sodium nitrate is mostly obtained as an inevitable by product from the production of iodine and potassium nitrate.

6. A summary of any available previous reviews by State or private certification programs or other organizations of the petitioned substance :

- *TAP reviews on "Chilean nitrate" (April 15, 2002).*
- *Replies to IFOAM comments on the substance 2004 ("IFOAM Evaluation of some controversial substances against the criteria in the Codex Guidelines for organically produced food", Codex Alimentarius (ALINORM 03/22A)), document attached.*
- *Organic Crop Production Overview; Fundamentals of Sustainable Agriculture, George Kuepper and Lance Gegner NCAT, August 2004; published by ATTRA .(ATTRA is the national sustainable agriculture information service operated by the National Centre for Appropriate Technology, through a grant from the Rural Business-Cooperative Service, U.S.D.A.(document attached).This document is referred to in the evaluation as OCPO.*
- *The publication "Natural Nitrogen Nitrogenous Rock; Use of Natural Chilean Nitrate in Organic Farming", H. Opdebeeck et al., 2004, document included.*
- *Reviews of the book "Natural Nitrogen Nitrogenous Rock; Use of Natural Chilean Nitrate in Organic Farming", by different Universities and experts from the USA, Belgium, The Netherlands, Korea, Chile and Switserland.*

7. Information regarding EPA, FDA, and State regulatory authority registrations, including registration numbers :

EPA PC Code: 076104

8. The Chemical Abstract Service (CAS) number or other product numbers of the substance and labels of products that contains the petitioned substance :

CAS Number: sodium nitrate 7631-99-4
DOT # NA 1487 Oxidizer
NOES 1983: HZD 69220; NIS 249; TNF 40765; NOS 152;
TNE 557740; TFE 110040
EINECS 231-554-3
ICSC #0185
RTECHS # WC5600000
UN #1498
WHMIS: C, D2B

9. The substance's physical properties and chemical mode of action including (a) chemical interactions with other substances, especially substances used in organic production; (b) toxicity and environmental persistence; (c) environmental impacts from its use or manufacture; (d) effects on human health; and, (e) effects on soil organisms, crops, or livestock :

- Characterization Composition:
sodium nitrate $NaNO_3$
- Physical and chemical properties
Appearance Form : Crystalline
Color : white
Odor : Odorless
Type Melting point : Value 306 °C

Type Boiling point : Value 380 °
Density : Value 1.2 g/cm³
Solubility in water : Value 900 g/l
Specific Gravity: 2.26
Stability: Stable
Hazardous Polymerization: Will not occur
Dissolution is endothermic
The aqueous solution is neutral.
- Properties:
It is available in synthetic form or from mined sources. The naturally occurring form, known as Chilean nitrate, is derived from caliche ore, a crude mineral conglomerate of salts comprised of: nitrates; sulfates; chlorides of sodium; calcium and potassium; magnesium; and various micronutrients (Ericksen, 1983).

For extensive review on (b),(c),(d) and (e) see decision sheet dated April 1 Petition Justification Statement document attached.

10. Safety information about the substance including a Material Safety Data Sheet (MSDS) and a substance report from the National Institute of Environmental Health Studies.
See attached MSDS documents

11. Research information about the substance which includes comprehensive substance research reviews and research bibliographies, including reviews and bibliographies which present contrasting positions to those presented by the petitioner in supporting the substance's inclusion on or removal from the National List.

- *Replies to IFOAM comments on the substance 2004 ("IFOAM Evaluation of some controversial substances against the criteria in the Codex Guidelines for organically produced food", Codex Alimentarius (ALINORM 03/22A)), document attached.*
- *Organic Crop Production Overview; Fundamentals of Sustainable Agriculture, George Kuepper and Lance Gegner NCAT, August 2004; published by ATTRA .(ATTRA is the national sustainable agriculture information service operated by the National Centre for Appropriate Technology, through a grant from the Rural Business-Cooperative Service, U.S.D.A.(document attached).This document is referred to in the evaluation as OCPO.The publication "Natural Nitrogen Nitrogenous Rock; Use of Natural Chilean Nitrate in Organic Farming", H. Opdebeeck et al., 2004, document included.*
- *Reviews of the book "Natural Nitrogen Nitrogenous Rock; Use of Natural Chilean Nitrate in Organic Farming", by different Universities and experts from the USA, Belgium, The Netherlands, Korea, Chile and Switserland.*

12. Petition Justification Statement

See separate file "Petition Justification Statement" inclusive decision sheets.

TAB 3

3

Natural Sodium Nitrate

SQM North America

Material Safety Data Sheet

SECTION I — IDENTIFICATION

Chemical Name **SODIUM NITRATE**	Chemical Name **NITRATES**	CAS. NO. **7631-99-4**
Trade Name **ALLGANIC NITROGEN**	Description **White** **Prills (Pellets) Solid**	Percent (Min.) **97.0**
Chemical Formula **N_ANO_3**	Synonyms **SODA NITER or** **BULLDOG SODA**	Mol. Wt. **85.01**

SECTION II — MANUFACTURERS INFORMATION

Manufactures Name **Sociedad Quimica y Minera de Chile, S.A.** **Santiago, Chile**	Emergency Telephone Numbers **Chemtrec 1-800-424-9300** **SQM North America 770-916-9430**
Address **SQM North America** **3101 Towercreek Parkway, Suite 450** **Atlanta, GA 30339**	For Information **Phone: 770-916-9430** Data Prepared **October 23, 1998**

SECTION III — INGREDIENTS INFORMATION

Component	OSHA PEL	ACGIH TLV	Other Limits Recommended	Significant Effects
Sodium Nitrate	**No Information Available**	**None Established**	**No Information Available**	**None Established**

SECTION IV — FIRE AND EXPLOSION DATA

Flash Point (Method Used)	Flammable Limits	OSHA Classification	Flammable Explosive Limits	
			Upper	Lower
Not Applicable	**No information available**	**Class 1 Oxidizer**	**Not Applicable**	**Not Applicable**

Extinguishing Media
Small Fires: Dry Chemical, CO_2,, water spray or foam
Large Fires: Water spray, fog or foam

Special Fire Fighting Procedures
Remove containers from fire if possible without risk. Cool containers exposed to flames with water. Use NIOSH/MSHA approved self-contained breathing apparatus where this material is involved in a fire.

Unusual Fire and Explosion Hazards
Oxidizer. Keep away from reducing agents, will explode if heated to 1,000 °F in presence of reducing agents, organic materials or mixed with cyanides. Yields gaseous oxides when heated.

SECTION V — HEALTH HAZARD DATA

Health Hazards Acute Exposure: **Irritation of skin and/or mucus membranes. Ingestion of large amounts causes violent gastroenteritis. Chronic exposure: Anemia, methemoglobinemia, nephritis. Route of exposure include inhalation, skin contact and ingestion.**

Symptoms of Overexposure: **Dizziness, abdominal cramps, vomiting, headache, mental impairment, cyanosis.**

Carcinogenicity: **Sodium Nitrate has not been directly implicated as a carcinogen. A constant oral intake of nitrate containing foods or water could lead to formation of carcinogenic N-Nitroso compounds.**

EMERGENCY FIRST AID PROCEDURES

INHALATION
Remove victim to fresh air, call a physician.

SKIN
Flush thoroughly with water

EYES
Flush with water for 15 minutes, call a physician.

INGESTION
Drink water, induce vomiting by sticking finger down throat, call a physician.

NATURAL SODIUM NITRATE

SECTION VI — TOXICOLOGY (Product)

Acute Oral LD 50 Acute Dermal LD 50 Acute Inhalation LC 50	**4.3/Kg (RATS)** **Not Determined** **Not Determined**	Carcinogenic: **not known to be carcinogenic** Mutagenic: **not know to be mutagenic** Eye irritation: **may be an irritant** Primary skin irritation: **may be an irritant**
Principle Routes of Absorption Oral, inhalation, skin		
Effects of Acute Exposure: dizziness, abdominal cramps, vomiting, headache, mental impairment, cyanosis, may cause skin, eye and mucous membrane irritation		
Effects of Chronic Exposure None expected at industrial use levels		

SECTION VII — REACTIVITY DATA

Stability (under normal conditions) Stable __X__Unstable_____	Incompatibility (material to avoid): avoid contact with reducing agents and flammable or combustible materials
Hazardous Poinerization May occur______ Will not occur_X___	Hazardous decomposition: produces oxides of nitrogen

SECTION VIII — PHYSICAL DATA

Boiling Point (°C) 380° (Decomposes)	Melting Point (°C) 306.8	Vapor Pressure (MM/Hg) Not applicable	Appearance White Prills (Pellets)
Solubility in water 91.9g/100ml at 25°C	Specific Gravity (H20=1) 2.26	Vapor Density (Air = 1) Not applicable	Evaporation Rate No information available

SECTION IX — SAFE HANDLING AND USE PRECAUTIONS

Waste disposal method **Sanitary landfill in accordance with federal, state and local regulations**	Other precautions **Wood and empty paper bags used to hold this product should be removed from the premises.**
Steps to be taken in case material is released or spilled **Wear impervious gloves, boots, wear goggles, coveralls. Wear NIOSH/MSHA approved dust respirator. Sweep or shovel up spilled material.**	**Handling and storing precautions** **Store away from reducing agents and liquids of low flashpoints. Storage area should be cool, dry, well ventilated and fireproof.**

SECTION X — CONTROL MEASURES

Respiratory protection NIOSH/MSHA-Approved dust type respirator	Ventilation Mechanical (General)
Protective gloves No special gloves needed	Eye Protection Goggles
Other protective clothing Coveralls and impervious boots	Work/hygienic practices Follow recommendations in section IX safe handling & use precautions and wash skin and clothing after contact

Material contained herein complies with OSHA communications standard, 29 CFR 1910. 1200. Standard must be consulted for specific requirements.

The information contained herein is, to best of our knowledge and belief, accurate. However, Chilean Nitrate sodium nitrate is sold without representations or warranties, express or implied, of fitness for use or purpose or of merchantability beyond the description of said material on the face hereof, and is sold on the condition that seller shall not be liable for accident, injury, or damage occasioned during or resulting from the transportation, handling, storage, sale or use of the material.

Information dated February 21, 2005

SQM North America
3101 Towercreek Parkway, Suite 450
Atlanta, GA 30339
Emergency Telephone: 770-916-9430

In the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemical call Chemtrec: 800-424-9300

TAB 4

EVALUATION OF NATURAL SODIUM NITRATE (ALSO SOMETIMES CALLED CHILEAN NITRATE) AGAINST CRITERIA FOR SUBSTANCES ADDED TO THE NATIONAL LIST

Introduction:

The substance currently is on the National List.

Since all substances on this list will be subject to review at the end of 2005 we submit this updated evaluation.

This evaluation is more elaborated than is usual for fertilizer inputs.

We thought this was necessary as several and major misunderstandings and confusions about the product apparently exist.

For most of the information contained in this evaluation we refer to:

- TAP reviews on "Chilean nitrate" (April 15, 2002) and "potassium sulfate" (September 12, 2002).
- Organic Crop Production Overview; Fundamentals of Sustainable Agriculture, George Kuepper and Lance Gegner NCAT, August 2004; published by ATTRA .(ATTRA is the national sustainable agriculture information service operated by the National Centre for Appropriate Technology, through a grant from the Rural Business-Cooperative Service, U.S.D.A.(document attached).This document is referred to in the evaluation as OCPO.
- Replies to IFOAM comments on the substance from 1989 ("Chilean Nitrate an evaluation for its use, respectively its non-use in organic agriculture", IFOAM Technical Committee, August 1989), document attached, and 2004 ("IFOAM Evaluation of some controversial substances against the criteria in the Codex Guidelines for organically produced food", Codex Alimentarius (ALINORM 03/22A)), document attached.
- The publication "Natural Nitrogen Nitrogenous Rock; Use of Natural Chilean Nitrate in Organic Farming", H. Opdebeeck et al., 2004, document included. This document is referred to in the evaluation as "the book NNNR".

It will be shown that the complementary use of Natural Sodium Nitrate fits very well in the definition of organic agriculture provided by NOSB:
"*An ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony.*"

IDENTIFICATION (SOURCE : TAP REVIEW ON CHILEAN NITRATE)

Substance	Description; compositional requirements; conditions of use
Natural Sodium Nitrate	**Product obtained from nitrogenous rock thru physical processes using mostly solar energy and without synthetic additives. To be used as a complement to the organic sources of nitrogen and according to local conditions. Should be certified by the authority or certification body.**

CAS Number:
sodium nitrate: 7631-99-4

Other Codes :
EPA PC Code: 076104
DOT # NA 1487 Oxidizer
NOES 1983: HZD 69220; NIS 249; TNF 40765; NOS 152; TNE 557740; TFE 110040
EINECS 231-554-3
ICSC #0185
RTECHS # WC5600000
UN #1498
WHMIS: C, D2B

Mineral content		
	%	ppm
N	16	
Na	26	
I		50-150
B		300-800
Ca		20-50
Fe		20-40
Cu		20-60
Zn		40-80
Mg		500-1500
Mn		300-700
S		1500-3000
SiO2		10-30

Category 1. Adverse impacts on humans or the environment? Substance: Natural Sodium Nitrate (NSN; Trade name: Allganic Nitrogen) also sometimes referred to as Chilean nitrate.

Question	[illegible]	[illegible]	[illegible]	Documentation (TAP; petition; regulatory agency; other)
1. Are there adverse effects on environment from manufacture, use, or disposal? [§205.600 b.2] 2. Is there environmental contamination during manufacture, use, misuse, or disposal? [§6518 m.3]				Questions 1 and 2 are answered together. **1.1 <u>Manufacture</u>** The ore bearing nitrate and other soluble salts is called caliche in Chile. The economically exploitable deposits are located in the north of the country, next to the east foot of the coastal ridge at 3300 feet above sea level, along a northbound strip 20 miles wide and 500 miles long. The genesis of nitrate deposits has been a matter of investigation for more than a century and many mechanisms for the fixation of nitrogen have been proposed . The caliche ore is known to mankind since the seventh century, used by the Atacameñan culture as fertilizer. In the beginning of the 1920's a process developed by the Research Labs of the Guggenheim Brothers in New York allowed to process large volumes of low grade ore with 8 to 10% nitrate content at 113°F. During the 90's the heap leaching of caliche ores in ponds was started, process done at ambient temperature with limited crushing of the ore and allowing for also lower grades of nitrate in the ore.(for more details see book NNNR ,section 2.1 pages 63-69 and fig 23 ,page 72). The environmental impact is not similar but is on the contrary much more environmental friendly compared to the mining and beneficiation of potassium sulphate, kainite, rock potash, rock phosphate, sylvinite, patentkali (potassium magnesium sulphate), kieserite and Epsom salt (all authorized in organic farming). In addition about 60% of the total energy used is solar and non-renewable energy used / unit of N is around 40% of the amount used by synthetic N manufacturers (SQM 2004, EFMA - European Fertilizer Manufacturers Association – 2004) (see also the book NNNR, page 12, (bottom), page 69 (top) and page 142 (top)). This will be improved even more in the near future. **1.2 <u>Use</u>** Solubility of fertilizers in general and N fertilizer in particular seems to be

				considered a negative feature in organic agriculture. However the **intended use** of Natural Chilean Nitrate in organic agriculture should be to improve N-efficiency and decrease N losses during some critical growing stages and by the same token improve crop quality and yield. At these particular growing stages this can only be achieved if that N source is plant available and thus present in the soil solution. Therefore solubility is **essential** in this context and will lead to diminished nitrate losses instead. See also answers on Q 3,5,6,7, 8 and 9 of this category . **1.3 Disposal** It should not be disposed of and can be stored for longer periods for subsequent cropping. No alteration of its characteristics takes place as long as fertilizer storage prescriptions are met.
3. Is the substance harmful to the environment? [§6517c(1)(A)(i);6517(c)(2)(A)i]				No, nitrate is not harmful to the environment; it is an essential and important plant nutrient; as with all other nutrients, only excessive amounts are harmful. In view of many misunderstandings and prejudices surrounding the term "nitrate" it may be worth to state once more the generally accepted scientific facts (points 1-8 and 10) about nitrate as plant nutrient. 1) N (nitrogen) is the most important plant nutrient (after water, CO2 and O2). 2) N is for over 90% taken up by all plants as nitrate in conventional as well as in organic agriculture. 3) N-fertilizers are mineral or organic. (Organic in this sense means compounds that contain C.) 4) Plants practically do not take up any organic N compounds and without nitrate in the soil a crop cannot survive. Nitrification (oxidation) is a spontaneous natural phenomenon. 5) To be plant available (almost) all N in those fertilizers has to be converted in nitrate if not already in that form. 6) Pollution of groundwater (or well water) with nitrates and excess of nitrate in crops is due to excess use of N-fertilizers (mineral or organic) or synchronization problems. 7) For the same amount of N-input, applied according best management practices leaching losses (as nitrate) and other N losses are mostly much higher from organic N-sources than from mineral N-sources. 8) The higher nitrate losses are mostly due to synchronization problems i.e. a time gap between plant nitrate needs and nitrate availability. 9) The intended use of NSN is not to replace nitrate from organic sources but to complement it in order to compensate this lack of synchronization. 10) This complementary use is one of the BMPs (Best Management Practices) to diminish nitrate pollution and at the same time will increase crop yield and quality.
4. Does the substance contain List 1, 2, or 3 inerts? [§6517 c (1)(B)(ii); 205.601(m)2]				The substance does not contain List 1, 2, or 3 inerts.
5. Is there potential for detrimental chemical interaction with other materials used? [§6518 m.1]				We are not aware of any and we refer to TAP-review on Chilean nitrate, page 3: "*No information was found detailing adverse chemical interactions with other organic inputs [i.e. other materials used]*".
6. Are there adverse biological and				Questions 6 and 7 are answered together.

chemical interactions in agro-ecosystem? [§6518 m.5] 7. Are there detrimental physiological effects on soil organisms, crops, or livestock? [§6518 m.5]				We refer first to some apparent contradictions between the TAP reviews for "Chilean Nitrate" and "Potassium Sulfate": - TAP-review on Chilean nitrate, Criterion 5, page 5: *"Additions of soluble nitrogen increases carbon mineralization rates, which may lead to a decrease in soil organic matter"*: this, as we understand, is considered a disadvantage. However in the TAP-review on synthetic potassium sulphate, Criterion 6, page 6: *"However, potassium sulphate has several advantages over potassium chloride ... in Podzolic soils ... potassium sulphate had a stronger effect on the mineralization of organic compounds".* - TAP-Review on potassium sulphate, reviewer 3, page 9 states: *"Criteria 1-5 are not relevant to this case. But this does not in itself qualify a substance for inclusion. It is not necessary for something to be grossly or subtly toxic or ecologically damaging for it to be inappropriate to organic agriculture. We could name several synthetically derived nitrogen fertilizer sources, for example, which if used in moderation, might not be harmful, and might in fact stimulate biological activity in the soil, yet these are clearly and unquestionably disqualified for inclusion on the National List [exactly because they are synthetic]"* (by the way but this is not the point right here, the natural origin of mineral fertilizers is considered here as a very important criterion). Further results from the Broadbalk Continuous (>140 years) Wheat Experiment, Rothamsted, UK, have showed that soils that received inorganic fertilizer contain more microbial biomass than soils from the corresponding plot that have not received inorganic N (Shen et al., 1989). Studies at the same site carried out by Glendining et al. (1996), confirmed that different rates of inorganic N fertilizer (48, 96,144 and 192 kg N/ha since 1852) had no effect on the soil microbial biomass N or C contents though there was some positive correlation with the specific mineralization rate of the biomass contents (defined as N-mineralized per unit of biomass). Although the size of the microbial population appears unchanged, its activity was greater in soils receiving long-continued applications of mineral N fertilizer. For more info see the book NNNR, page 110. Other fast acting N fertilizers like feather meal, bone meal, blood meal, etc. are only acting fast because they are hydrolyzed or because they contain *"substantial amounts of mineral N"* (TAP review on Chilean nitrate, page 7). Natural Chilean nitrate stimulates very well microbial life but more in an indirect and sustained way through increased biomass (yield) and through synergy with organic fertilizers. Indeed the highest biological activity is obtained with the combination of organic fertilizer and (pH increasing) complementary mineral fertilizer like natural Chilean nitrate. For example earthworms: research by Edwards and Lofty (1982) at Rothamsted, UK, and other research papers quoted by Lampkin (2002), found that plots receiving both organic and mineral N had the largest population of earthworms. See also the book NNNR, section 3.1.4.1, pages 114-115. Further we refer to the following quote from the TAP review on Chilean nitrate, page 7 : *"If used in moderation, none of these nitrate-containing materials [Chilean nitrate, ..., etc.] would have serious detrimental effects on the soil biota. The presence of significant quantities of nitrate in organically managed soils is not unusual; following the breakdown of a legume cover crop, a buildup of 10-20 mg/kg NO_3^--N is common. Manure-*

based compost may also introduce substantial nitrate (NO_3^--N) when irrigation is inefficiently managed".

The activity of N-fixing organisms will not be affected because at that very moment it is exactly the activity of N-fixing organisms that is lacking and is therefore one of the causes of the N-gap instead of the effect. There should be no confusion between cause and effect. Also N-fixing organisms live in symbiosis with legumes. NSN is not intended to be used on legume crops.

Finally NSN application in organic farming was never intended to be used as sole source of N but only in harmonious complementary synergetic use with already authorized organic fertilizers using the strength of both types of input to bridge the critical nutritional N-gap.

8. Is there a toxic or other adverse action of the material or its breakdown products?
[§6518 m.2]

There is no toxic or other adverse action of the material or its breakdown products.

9. Is there undesirable persistence or concentration of the material or breakdown products in environment?[§6518 m.2]

Sometimes the salt index of NSN and therefore the risk of Na accumulation is mentioned in some literature. There will be no accumulation if NSN is used as intended: see the book NNNR section 1.1.2.3 page 37-40, and section 3.1.2.2., page 94-95.
Further we refer to the following documentation:

- From the TAP-reviews on synthetic SOP :

  page 3, International certifiers: "*UN FAO Codex Alimentarius guidelines allow the use of "rock potash" and "mined potassium salts" which are "less than 60% chlorine.*" : But the most purified KCl-fertilizer (60% K_2O) contains "only" 48% chlorine. This would mean that the permitted chlorine level is unlimited.

  page 4, criterion 2: "*By comparison, potassium chloride (muriate of potash) has a benchmark salt index of 116, higher than both sodium nitrate (100) and ammonium nitrate (105)".*

  page 5, criterion 3 in Table 1: "Manure salts" (20%) have a salt index of 5.6 * 20 = 112

TABLE 1 Salt Index of some inorganic potassium fertilizers

Material	%P_2O_5	Salt Index per Unit of Plant Nutrients
Manure salts, 20%	20.0	5.636
Potassium chloride	60.0	1.936
Potassium nitrate	46.6	1.580
Potassium sulfate	54.0	0.853
Potassium magnesium sulfate	21.9	1.971

Adapted from Rader et al. 1943

Error in the above table: instead of P2O5 read K2O.

  page 5, criterion 5: "*... sodium (Na+) is similar to potassium in its chemical properties, and has been shown to substitute partially for potassium in some crops (Thompson, no date)".*

page. 6, criterion 6: "*Sullivan and colleagues (2000) report that manures contain 0.6% salts on a dry weight basis, and that 20 tons of fresh manure would add 90lbs salt/acre*".

page 6, criterion 6: "*Unrefined sylvinite (KCl•NaCl) contains 20-30 percent K_2O*". [and 20-25% Na and 30-40% Cl] Sylvinite is an authorized natural mineral fertilizer. Magnesium-kainite also an authorized natural mineral fertilizer contains 20% of Na. NSN does not even contain Cl.

page 7, TAP reviewer 1, criterion 5: « *In this regard this product [SOP] is preferable to the use of manure-based composts, which have higher salt content (including chloride) per unit of K content. Use at reasonable agronomic rates has minimal consequences on soil salinity*".
This statement is even truer for NSN (expressed per unit of nutrient) when accounting for all relevant data: salt indexes, N-content and efficiency of N in NSN compared to efficiency of N in manure and compost.

page 7, criterion 6: "*Manure compost can contain substantial K, but repeated use of these products can result in a build-up of soil P to environmentally undesirable levels. Furthermore, manure composts can contain high salt concentration, which requires leaching to maintain soil productivity.*"

- From the TAP-review on Chilean nitrate

page 7, Reviewer 1: "*Much is also made about the high salt index of sodium nitrate, but application of this product at the levels allowed under section 205.602(h) presents little risk in either of these regards. In the eastern U.S. annual rainfall is generally sufficient to maintain salt balance, and in the West the amount of sodium applied in this fertilizer pales in comparison to that contained in most irrigation waters. Also, organic soil building practices generally provide sufficient organic matter to maintain good soil tilth*".

- Following some more quotes and references about sodium in organic amendments and fertilizers:

"*The salt index of liquid manure is very high. This material kills earthworms and hardens the ground*", NODPA News (Northeast organic dairy producers alliance, USA), vol. 2, issue 2, July 2002.

"*Composting reduces the amount of raw material by about 2/3, yielding about 35% of the original raw material weight as compost. Sodium concentration in livestock manure can result in compost with sodium concentrations too high for some uses such as potting mixes.*", (Recipes for building compost windrows, Dr. Paul Walker, Department of Agriculture, Illinois State University, USA).

"*Most of the studies involving salinity have been conducted on the effect of inorganic fertilizers on plant growth and mineral nutrition. However, the literature on the response of crops to short-term application of composted manure under saline conditions is scanty.*", (Influence of composted manure and salinity on growth and nutrient content of maize tissue, Irshad m., Yamamoto S., Eneji A.E. and Honna T., Laboratory of Soil Science, Faculty of

				Agriculture, Tottori University, Tottori City, 680-8553, Japan). "*Manure commonly contains 4 to 5% soluble salts (dry weight basis) and may run as high as 10%. To illustrate, an application of 5 tons [dry weight] of manure containing 5% salt would add 500 lbs. of salt.*", (Ecochem, Innovative Solutions, For sustainable Agriculture & Waste Management, March 24, 2004).
10. Is there any harmful effect on human health? [§6517 c (1)(A)(i) ; 6517 c(2)(A)i; §6518 m.4] 11. Is there an adverse effect on human health as defined by applicable Federal regulations? [205.600 b.3] 12. Is the substance GRAS when used according to FDA's good manufacturing practices? [§205.600 b.5]				Questions 10,11and 12 are answered together. We refer to category 1, question 3 of this evaluation and the following is added: Organic crops in general may indeed be lower in nitrate when compared to crops fertilized with heavy doses of mineral N. However taking into account the [recent] evolution in [conventional] agriculture practices, particularly for N fertilization and even more when nitrate is used only to cover certain critical crop needs as a complementary fertilizer and not as a unique N source, nitrate accumulation is not to be expected. Indeed the proposed use of natural sodium nitrate is <u>on a complementary base as part of a systemic approach.</u> Any N-fertilizer (mineral or easily decomposable organic fertilizers such as blood meal, bone meal, feather meal, bean meal, guano,) might increase nitrate accumulation in the crop especially with excessive application rates (Termine et al., 1987). Avoiding excessive use of any nitrogen source including organic amendments is exactly the aim of this complementary use and this as part of a systemic/holistic approach. Referring to the <u>TAP-review</u> on Chilean nitrate on page 7: "*It is true that application of this product late in the crop cycle of leafy greens (the expected use pattern) would increase the nitrate concentration of the produce, but it would be <u>very unlikely</u> to result in levels deemed a health hazard by current standards. In my research on conventionally grown lettuce produced in the Salinas Valley, I have <u>never found</u> nitrate levels in the edible portion to exceed the standards set by the European Community, even in field situations where <u>excessive amounts</u> of synthetic fertilizer was used. Other researchers have found that conventionally produced California spinach occasionally exceeds these standards, but the likelihood of any organic production, even with the use of sodium nitrate, approaching or exceeding these standards is remote*". The intention is complementary use and certainly not "*excessive amounts*".
13. Does the substance contain residues of heavy metals or other contaminants in excess of FDA tolerances? [§205.600 b.5]				-The heavy metals content by far does not exceed FDA tolerances, is negligible and far lower than in most other authorized organic fertilizers (for more detailed information see the book NNNR, section 3.2.3, pages 118-121). -NSN contains some residual traces of perchlorates as do other natural minerals like rock potash and other fertilizers like blood meal, fish meal and kelp (Orris et al., USGS, 2003). Despite the fact that, to our knowledge, no maximum tolerance levels for perchlorates have been established neither in USA nor in EU nor in other countries, the manufacturer SQM has on a continuous basis diminished the level of remaining traces in the product on its own initiative following the perchlorates industrial pollution problem in the USA at the end of the nineties (Ammonium perchlorate manufactured in large quantities for use as oxidizer agent in solid propellant for rockets, missiles, fireworks, explosives, flares, herbicides, tracer munitions, detergents and automobile air bag inflators (Joint Groundwater Monitoring and Contamination Report, SFR-056/03, 2004).

				The US EPA (2002a) and TFI (2002) studies have refuted the fact that Chilean nitrate could be a contributing factor in perchlorate contaminated surface- and ground water. This is further confirmed by the fact that on January 11th, 2005, the National Academies (NAS), advisers to the Nation on Science, Engineering and Medicine, after reviewing the current state of the science, recommended a draft RfD of 0.0007 mg/Kg body weight. i.e. 23 times higher than the preliminary EPA 2002 safe level, We refer also to the following quotes from the TAP-review of Chilean nitrate: • page 5, criterion 4: "*While perchlorate contamination in potable water is difficult to treat (Urbansky & Schock 1999), microbes [in the soil] capable of reducing the anion appear to be abundant (Logan, 1998, Coates et al. 1999, Nzengung & Wang 2000).*" • page 8: "*However, the petition states that changes in the manufacturing processes have lead to less perchlorate content of the finished product. The soil microbial community should easily process the low level of perchlorate. Overall the low level of perchlorate should not pose human health problems at the recommended application rate.*"

[1]If the substance under review is for crops or livestock production, all of the questions from 205.600 (b) are N/A—not applicable.

Category 2. Is the Substance Essential for Organic Production? Substance NSN

Question	Yes	No	N/A	Documentation (TAP; petition; regulatory agency; other)
1. Is the substance formulated or manufactured by a chemical process? [6502 (21)] 2. Is the substance formulated or manufactured by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral, sources? [6502 (21)]				Questions 1 and 2 are answered together. No chemical transformations, not even ion exchanges, are used which is unique among mineral fertilizers including those used in organic agriculture. Further we refer to the book NNNR section 2.5.2 pages 67 and 68. See also category 1, question 1 and 2 of this evaluation.
3. Is the substance created by naturally occurring biological processes? [6502 (21)]				Nitrogen fixation is a naturally occurring biological process. It is probable that the NSN deposits have been formed by naturally occurring biological processes.
4. Is there a natural source of the substance? [§205.600 b.1]				NSN is the natural source of natural nitrate.
5. Is there an organic substitute? [§205.600 b.1]				As over time consumer expectations regarding quality and extended-season availability evolved and as new high performing plant varieties could not be nourished in the same way as their low yield ancestors, if yields close to their potential[1] were to be obtained, quick acting N-fertilizers, besides NSN, were introduced in the form of animal refuse like blood meal, bone meal, feather meal, etc. On the first sight those alternatives seemed to fit better in the organic mindset as they contained some C (C/N average of 3, close to that of urea) and therefore concepts like humus and SOM (Soil Organic Matter) building apparently could be associated with such inputs. However it may be reminded that: • Animal refuse does <u>not</u> produce humus. One of the basic and most important principles of organic production is the maintenance of an adequate rate of humus (unstable and stable) that in turn maintains and stimulates biological life throughout the vegetative cycle and maintains soil structure, etc. Fertilizers of animal origin do not leave any humus and their "episodic" use will no more or no less stimulate bacterial life than NSN (which does not mean they don't). • When hydrolyzed and therefore digestible it will not even contribute to SOM. • Animal refuse derived fertilizers have the following

[1] Within organic farming restrictions.

				drawbacks: - If animal residues effectively do contain"... *substantial amounts of mineral N*" (TAP review on "Chilean nitrate", page 7), and if the farmer is not aware of this, untimely use and its consequences will result. When hydrolyzed Q1 and Q2 above will have to be answered affirmatively for those fertilizers. - Health hazards: blood, bone and meat meal are prohibited in many countries in Europe and Japan because of BSE transmission risk. *Cattle waste can lead to Anthrax disease caused by infection with Bacillus anthracis .... Partly because of its persistence in soil, anthrax is a rather important veterinary disease, especially of domestic herbivores. (Clinical and Epidemiologic Principles of Anthrax ,Theodore J. Cieslak and et al., U.S. Army Medical Research Institute of Infectious Diseases, Ft. Detrick, Maryland, USA ,1999).* *Endemic outbreaks occur... where...environmental conditions favor an animal-soil-animal cycle.* *Industrial cases may occur anywhere and reflect exposure to imported animal carcass products, such as bone meal (Which is used for making glues or fertilizer), hair, or hides (Thappa DM et al., Cutaneous anthrax, Indian Journal of Dermatology Venereology and leprology, 2002, Volume : 68/ Issue : 6) (more on this in cat. 3, question 2).* Feather meal recently is presenting a much greater hazard still:Avian flu is transmissible and has been transmitted recently to other animals and people in Asia and Europe and according to WHO is currently one of the major new threats to human health and according to Tommy Thomson, US Health Secretary, the n° 1 concern of his successor is the possibility of an Avian Flu pandemic (New Farm, 2004). Fishmeal contains high levels of PCBs which accumulate in the soil particularly when used in high-input agriculture.(In fact fishmeal as organic animal feedstuff has been recently explicitly forbidden in the USA exactly for this reason.). Instead NSN is used since more than 100 years and, to our knowledge, never presented any health problems. Therefore it certainly satisfies amply the Principle of precaution so dear to organic farming. - The traceability of feathers and other animal wastes is doubtful .Therefore contaminants like antibiotics, hormones etc might be introduced in the system. For more detailed information see the book NNNR, section 1.4, page 59.(enclosed). In short, isn't it more straightforward, consistent and prudent to continue adhering to the well-tried principle that has been applied since the birth of organic farming i.e. complementing organic vegetative amendments with natural minerals (soluble or not) when really necessary and this for all nutrients?
6. Is the substance essential for handling of organically produced agricultural products? [§205.600 b.6]				N/A
7. Is there a wholly natural substitute				We refer to question 5 above and to the TAP-review on Chilean

product? [§6517 c (1)(A)(ii)]				nitrate, page 6: "*Smith (1992) determined that the nitrogen release curve for a combined cover crop/feather meal amendment was inadequate to supply late-season nitrogen demand in bell peppers*". and the same TAP-review, page 9: "*[If Chilean nitrate is disallowed], it seems inevitable that an alternative source of fertilizer N with predictable nitrogen release characteristics will have to be found [but hasn't been found yet].*"
8. Is the substance used in handling, not synthetic, but not organically produced? [§6517 c (1)(B)(iii)]				N/A
9. Is there any alternative substances? [§6518 m.6]				See question 5 above.
10. Is there another practice that would make the substance unnecessary? [§6518 m.6]				If legume crops as an intercrop (companion planting) would be able to release nitrate on demand for the adjoining crops the substance would then become unnecessary.

[1]If the substance under review is for crops or livestock production, all of the questions from 205.600 (b)are N/A—not applicable.

Category 3. Is the substance compatible with organic production practices?

Substance ____________________

Question	Yes	No	N/A	Documentation (TAP, petition, regulatory agency, other)
1. Is the substance compatible with organic handling? [§205.600 b.2]				N/A
2. Is the substance consistent with organic farming and handling? [§6517 c (1)(A)(iii); 6517 c (2)(A)(ii)]				The substance is consistent with organic farming. This has been shown in the answers on Q6 and 7 of Cat.1 and Q5 of Cat 2. We add the following comments: a) The intended use of NSN is complementary. b) In organic agriculture the notion "feed the soil to feed the plant " is seen as fundamental. However foliar fertiliser is "*commonly used by many organic growers. The fertilizer materials used are typically soluble fish- and seaweed-based products, naturally chelated nutrients, humic acid extracts, and teas made from plants, dried blood, manure, guano, or compost*" (OCPO.page 21). Even synthetic micronutrients in many European countries are allowed. Compared to NSN use thru soil/roots, the use of foliar feeding appears much more in conflict with that organic notion. It doesn't even exist naturally and looks more like force feeding so to say.(note that most of above mentioned foliar fertilizers are basically N/nitrate fertilizers). Even then (quoting OCPO, page 21) "*organic growers rationalize the use of this approach on two points.* *1. Foliar feeding is strictly supplemental fertilization; it is not used as a substitute for traditional soil building practices.* This is equally true for NSN. *2. Foliar fertilization is understood to increase the production of root exudates, which stimulates biological activity in the rhizosphere (soil area adjacent to plant roots). The soil bio-life gets considerable benefit in this indirect way from foliar feeding*". This is certainly a more proven fact when (natural sodium) nitrate is applied to the soil (see also answer on Q6 and Q7 under cat. 1). c) NSN contains most plant micronutrients at significant rates (see page 1). This is in contrast to "*conventional fertilization (that) tends to concentrate on a limited number of macronutrients, even though the need for at least 13 soil minerals is scientifically recognised*" (OCPO.page 6) Conversely this is supported by the quote: "*Less common*[-ly used to correct mineral deficiencies*] are other rock powders and fines that are limited sources for the major nutrients but are rich in micronutrients or have some other soil improving characteristic*" (OCPO, page 17). NSN is a major source of both. d) Even though "(*significant research remains to be done), Organic*

				proponents also believe that insect pests are attracted to inferior or weak plants — the result of poor crop nutrition" (OCPO.page 7). Complementary use of NSN improves crop nutrition and quality as demonstrated in preceding replies on questions and referred to /included documentation. e) If the complementary use of soluble minerals even in certain well defined critical conditions for a given crop could be considered "*to try to circumvent the soil's digestive process*" (OCPO.page 6), this is certainly more the case for (soluble) potassium and magnesium sulphate also used in org. agriculture. Even in conventional agriculture K, Mg (and P for that matter) are applied to nourish the soil in the first place. Regarding the S source of those fertilizers, it should be noted that S (sulphate) and N (nitrate) have similar characteristics (e.g. solubility) and above all their biological cycles are very similar.(see book NNNR, section 1.2.3, page 50). Also most animal waste fertilisers are mostly mineralised, particularly when hydrolysed, and may therefore be misused as farmers may assume they are slower acting then they are in reality. f) The practise of using animal waste as fertiliser in high-input organic agriculture is recent. Yet in the memory of mankind farmers did not use dead terrestrial animals as fertiliser as most probably they knew from their forebears or felt this to be a health hazardous and unnatural practice. For example : Anthrax, a bacterial disease, is still common in many countries with recent outbreaks on farms in the USA. It can be transmitted from cattle to humans thru animal wastes particularly when in powder meal and can stay active in the soil for many decades. *Endemic outbreaks occur where animal-soil-animal cycles are favoured.* Conversely the fact that even conventional farmers used and still use fish waste (that does not enter in the disease cycle) is another strong indirect proof that this traditional behaviour i.e. not to use terrestrial animal waste as fertilizer was and still is sensible. "*Human manures are expressly forbidden in certified organic production*". (OCPO.page 12) because of health risks. It is therefore difficult to understand why animal waste that can transmit diseases to other animals and humans like e.g. Avian flu thru feathers is allowed. This practise is closer to the "*romantic*" and "*collectively known approach of "organic by neglect""* (terms used in OCPO page 3) and is *a* far cry from the responsible farming models proposed by Albert Howard and J.I. Rodale. As contamination risks are acknowledged for animal manure, and therefore the 90/120 day rule was imposed, why then not for animal waste? Further, animal waste contains, besides N, also P and K and can therefore and will, particularly in high-input organic agriculture, already high on (NPK) compost, easily lead to excess levels of these elements. This is in contradiction with the "Balanced Nutrition" organic principle.
3. Is the substance compatible with a system of sustainable agriculture? [§6518 m.7]				1) Use of natural <u>resources:</u> All mineral resources are limited. This is also the case for potash, phosphate, calcified kelp, etc. The caliche ore in Chile will last for at least several more centuries and NSN is mostly a by-product of iodine extraction. Also China is mining nitrogenous rock and other deposits were discovered recently in Kazakhstan. Concerning the environmental impact due to long distance travel, the overall balance should rather be made. Knowing that 1kg N produces around 20 kg wheat (assuming average yields) (Finck, 1979), what is preferable in the point of view of socio-economic and environmental

				criteria: - Either importing the organic wheat or importing 30% of this quantity in equivalent Natural Chilean Nitrate (20 kg wheat for 1 kg N or 3-4 kg Natural Chilean Nitrate) both from overseas and both by vessel? - Flying in by plane early vegetables (in crates and the crates in an air shipping container) instead of a much smaller quantity of Natural Chilean Nitrate in bulk by vessel? See the book NNNR section 5.1 for more details. Even when not considering environmental and sustainability criteria ("food-miles"), the mere economic arguments above call for the local production option. Nevertheless in Switzerland for example, over 95% of organic wheat is imported from overseas (Swiss import export statistics, Direction Générale des Douanes, Bern, 2002). It could be produced locally if better protein content (baking quality) could be obtained i.e. better N nutrition as is the case for conventional wheat which is almost all locally produced. This same problem exists in USA: experiments are conducted at Ohio State University for example on hard wheat production in an attempt to improve protein level and baking quality of organic wheat (contact Deb Stinner, OFFER). In the production process of NSN more than 60% of the energy used is solar and this will be even more improved in the near future. Hydrolysis of animal wastes, besides rendering the fertilizer synthetic, is a high energy consuming process. <u>Maintaining soil fertility</u> Long term trials like the Limburgerhof trial 8 (23 years) (Jürgens-Gschwind & Jung, 1977) in Germany and the 40 year trial in Switzerland (Vullioud et al., 2004) show that a higher humus level is obtained when mineral fertilizer is added to manure (see the book NNNR, section 3.2.1, page 92). The above long-term experiments and others suggest that complementary use of Natural Chilean Nitrate would not have a direct impact on microbial biomass as SOM content would not be affected negatively. Moreover, only vegetative waste can increase soil humus content. Fertilizer produced from animal waste, as bone meal, feather meal, etc., does not increase humus and when hydrolysed not even SOM, except indirectly through higher yields and consequently a larger amount of crop residues that stay on the field. The same can be said of Natural Chilean Nitrate. More information on carbon input, C/N ratio: see the book NNNR, section1.2.2.4, page 49. (N – mineralization in relation to C/N ratio of organic amendments); More information on biomass and mineralization: see the book NNNR, section 3.1.4, page 109. (Encouragement and enhancement of biological cycles within the farming system, involving micro-organisms, soil flora and fauna, plants and animals). Conclusion: "*Even if sustainability is an ideal.*" (OCPO. page 6) the use of NSN contributes to sustainable agriculture in that it lowers fossil fuel consumption, lessens nitrate leaching and promotes greater carbon sequestration. Finally there is no overall sustainability without financial sustainability and "*The high cost of soluble organic fertilizer (typically hundreds of*

				dollars/acre), however, plus the marginally higher cost of pest controls, make such systems largely non-competitive in the conventional marketplace."(OCPO page 16). NSN is significantly less expensive than all other rapid N fertilisers and contributes therefore substantially to the financial sustainability of organic agriculture as well.
4. Is the nutritional quality of the food maintained with the substance? [§205.600 b.3]				The nutritional quality is improved in the first place due to generally higher protein content e.g. in wheat (see the book NNNR page 29) and through increased natural micronutrient content. "*An essential difference between many natural and synthetic fertilizers is the degree of their purity. Farmyard manure contains not only nitrogen but also provides all necessary plant nutrients; Natural Chilean Nitrate contains many admixtures in contrast to synthetic sodium nitrate that is essentially a pure chemical. The trend to increase the purity of fertilizers is no justification at all for considering them to be harmful. But it does represent a potential danger to food quality because of a possible one-sidedness in fertilization. On the other hand a greater purity also ensures smaller amounts of possible detrimental admixtures*" (Finck, 1979). Following quote from the TAP-review on synthetic SOP: *"We could name several synthetically derived nitrogen fertilizer sources, for example, which if used in moderation, might not be harmful, and might in fact stimulate biological activity in the soil, yet these are clearly and unquestionably disqualified for inclusion on the National List [exactly because they are synthetic] ».* This clearly says that synthetic mineral N-fertilizer should not be used and also says why natural N mineral fertilizer should be used.
5. Is the primary use as a preservative? [§205.600 b.4]				N/A
6. Is the primary use to recreate or improve flavors, colors, textures, or nutritive values lost in processing (except when required by law, e.g., vitamin D in milk)? [205.600 b.4]				N/A
7. Is the substance used in production, and does it contain an active synthetic ingredient in the following categories: a. copper and sulfur compounds;				N/A
b. toxins derived from bacteria;				N/A
c. pheromones, soaps, horticultural oils, fish emulsions, treated seed, vitamins and minerals?				N/A

d. livestock parasiticides and medicines?				N/A
e. production aids including netting, tree wraps and seals, insect traps, sticky barriers, row covers, and equipment cleaners?				N/A

[1]If the substance under review is for crops or livestock production, all of the questions from 205.600 (b) are N/A—not applicable.

NOSB RECOMMENDED DECISION

Form NOPLIST2. Full Board Transmittal to NOP

For NOSB Meeting: ____________________ Substance: __________________________

A. Evaluation Criteria (Documentation attached; committee recommendation attached)

		Criteria Satisfied?
1.	Impact on humans and environment	Yes ☐ No ☐ (see B below)
2.	Availability criteria	Yes ☐ No ☐ (see B below)
3.	Compatibility & consistency	Yes ☐ No ☐ (see B below)

B. Substance fails criteria?

Criteria category: _________

Comments:

C. Proposed Annotation: ____________________________________

Basis for annotation:

To meet criteria above: ____ Criteria: _____________

Other regulatory criteria: ____ Citation: _____________

D. Final Board Action & Vote: Motion by: ___________________ Second: _________________________

Vote:

Yes: _____

No: _____

Abstain: _____

Agricultural		Nonagricultural		Crops	
Synthetic		Not synthetic		Livestock	
Allowed[1]		Prohibited[2]		Handling	
No restriction		Deferred4		Rejected[3]	

1—substance voted to be added as "allowed" on National List

Annotation: ____

2—substance to be added to "prohibited" paragraph of National List

Describe why a prohibited substance: ______________________________

3—substance was rejected by vote for amending National List

Describe why material was rejected: ______________________________

4-substance was recommended to be deferred

Describe why deferred; if any follow-up is needed. If follow-up needed, who conducts follow-up. ______________________________

E. Approved by NOSB Chair to transmit to NOP:

Dave Carter, NOSB Chair ____________________ Date ____________________

F. NOP Action: Include in FR to amend National List: ☐

Return to NOSB ☐ Reason: ______________________________

Richard H. Mathews, Program Manager ____________________ Date ____________________

NOSB COMMITTEE RECOMMENDATION

Form NOPLIST1. Committee Transmittal to NOSB

For NOSB Meeting: ____________________ Substance: ________________________

Committee: Crops ☐ Livestock ☐ Handling ☐

A. Evaluation Criteria (Documentation attached; committee recommendation attached)

		Criteria Satisfied?
4.	Impact on humans and environment	Yes ☐ No ☐ (see B below)
5.	Availability criteria	Yes ☐ No ☐ (see B below)
6.	Compatibility & consistency	Yes ☐ No ☐ (see B below)

B. Substance fails criteria?

Criteria category: _________

Comments:

C. Proposed Annotation: ____

____

Basis for annotation:

To meet criteria above: ____ Criteria: _______________

Other regulatory criteria: ____ Citation: _______________

D. Recommended Committee Action & Vote: Motion by: _________________________

Seconded: ___________________________

Vote:

Yes: _____

No: _____

Abstain: _____

Agricultural		Nonagricultural		Crops	
Synthetic		Not synthetic		Livestock	
Allowed[1]		Prohibited[2]		Handling	
No restriction		Deferred4		Rejected[3]	

1—substance voted to be added as "allowed" on National List

Annotation: ____

____

2—substance to be added to "prohibited" paragraph of National List

Describe why a prohibited substance: ____

____

3—substance was rejected by vote for amending National List

Describe why material was rejected: ____

____

4-substance was recommended to be deferred

Describe why deferred; if follow-up is needed. If follow-up needed, who will follow up____

____

E. Approved by Committee Chair to transmit to NOSB:

______________________________ Committee Chair

______________________ Date

TAB 5

Founex le 17 avril 2004

Jean-Pierre Ryser
Grand Rue 2
1297 Founex

Monsieur
Herwig H. Opdebeeck
Directeur Opdebeek SA
Rue de Latigny 3
1955 Chamoson

Concerne: Document « NATURAL NITROGEN NITROGENOUS ROCK »

Monsieur,

Bien qu'ayant consulté tout le document, mon appréciation technique se limite aux chapitres 1, 3 et 4 pour lesquels ma spécialisation et mon activité antérieure me permettent un avis objectif.

Je vous félicite pour l'importance et la qualité du travail fournis. Le document est bon, bien présenté et bien structuré. Il est clair et facile à lire. Les recherches bibliographiques entreprises sont très importantes et les arguments sont en général étayés par plusieurs références d'auteurs reconnus et de pays différents. Les publications citées sont récentes et elles relatent d'essais de longue durée. Les résultats ne me surprennent pas, ils correspondent aux expériences que je connais et aux résultats obtenus durant ma carrière professionnelle.

Si j'ai bien compris, ce travail doit servir à démontrer que le nitrate du Chili est un produit compatible avec les principes de la culture biologique. Je me permets de vous rendre attentif qu'en général, et en particulier en suisse, les règles de la culture biologique émanent des organisations professionnelles. Ce sont elles qu'il y lieu de sensibiliser car elles régissent les listes de produits compatibles avec leurs convictions. Comme vous, je suis acquis au fait que les arguments de ce document montrent clairement que le nitrate de sodium du Chili peut convenir au complexe d'exigences de la production biologique.

D'autre part, je me permets de vous signaler une erreur de numérotation de tableau. A la page 114, le tableau 13 est cité dans le texte mais il s'agit en fait du tableau 25 qui se trouve sur la même page. La référence *Vuilloud P., Mercier E. et Ryser J-P.. non publiée* est parue dans la Revue suisse d'agriculture 36 (2) p.43-51.2004.

Restant à votre disposition pour tous compléments d'information, je vous prie d'agréer, Monsieur, mes salutations respectueuses.

J.-P. Ryser

UNIVERSITEIT GENT

FACULTEIT LANDBOUWKUNDIGE EN TOEGEPASTE BIOLOGISCHE WETENSCHAPPEN

VAKGROEP TOEGEPASTE ANALYTISCHE EN FYSISCHE CHEMIE
Prof. Dr. ir. Oswald Van Cleemput

Uw kenmerk	Ons kenmerk	Datum
		17 april 2004

Natural Nitrogen – Nitrogenous Rock
Use of Natural Chilean Nitrate in Organic Farming

Opdebeek et al.

Review

It has been shown that, in organic farming, N input with the aim of sufficient quantity and high quality of harvested crops is not easy to manage. This is the result of the basic principle of organic farming, i.e. not to use any synthetic fertilizer or other agro-chemical product, but rather rely on crop rotation, legumes, crop residues, etc.
In Section 1, it is clearly demonstrated that organic farming in Europe as well as in the USA is less performing than conventional farming. An important reason is lack of synchronization between applied (organic) N and the plant need for N. Indeed, mineralization of organic matter/substances is a continuous process, influenced by environmental parameters, resulting in a continuous supply of N, even if the plant requirement is low. This problem can be solved by supplementing (side-dressing) the mineralized soil N with Natural Chilean Nitrate (NCN), however, in correct amounts and timing. This is perfectly possible as NCN is a natural N compound. In addition, the presence of sodium, iodine and other trace elements have a positive effect on crop quality. A number of fertilization examples illustrates the necessity of combining N-mineralization with N side-dressing. The authors proof by a number of criteria that NCN fulfils all requirements to be used as side-dressing in organic farming.
In Section 2, a description of the NCN mining is presented and a comparison is made with other nutrient minings. This detailed description makes it clear that with the mining of NCN no chemical reactions are involved and that the potential environmental effect is low and definitely better than potash or rock-phosphate mining.
From Section 3 it is clear that the mineralization rate of organic compounds, N availability and N efficiency are crucial factors in the maintenance and even increase of the soil fertility in the long term. Effects on soil flora and fauna need to be considered as well. In addition, the stability of the soil pH is crucial and soil acidification should be avoided. The authors correctly prove in Section 3 that NCN is one of the least contaminating fertilizer and it does not acidify the soil.
As illustrated in Section 4, the application of nitrate, when properly (amount and time) used, will not lead to groundwater/surface water contamination. The iodine and sodium from NCN have even a positive health effect.
In Section 5, an excellent discussion is made on the comparison of characteristics of organic farming and the role that NCN can play within this agricultural activity.

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A matrix for evaluation of NCN against a number of criteria is given in Section 6. It is clear that NCN, as natural non-synthetic products, offers a unique possibility to improve quantity and quality of harvested crops in organic farming. Correct doses and timing remain necessary.

The presented book is very well written and structured. It tackles all problems related to organic farming, and it shows the possibilities for use of Natural Chilean Nitrate to improve quantity and quality of produced food. The book is illustrated with practical examples and the literature is well balanced. It covers existing knowledge as well as recent papers.

Prof. O. Van Cleemput

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Review of 'Use of natural Chilean nitrate in organic farming', by Opdebeeck et al.

The purpose of this booklet is obviously advocacy, in that it was written specifically to convince international organizations that mined sodium nitrate from Chile should be permitted to be used in organic agriculture. Despite this clear agenda, I found the data presentation to be responsible, and the argument for the use of sodium nitrate to be scientifically convincing. Regarding the main agronomic issues in this controversy, my comments are:

a) need for a mineral N source to supplement organic fertility

Despite the use of legume cover crops and the application of organic amendments (most commonly composted manure), N deficiency remains a common problem in organic production of high N requirement crops. In California vegetable production (the area of my expertise), N deficiency in organic fields remains a frequent occurrence, and yield loss is often the result. It is possible to maintain N sufficiency with only a high N content winter cover crop and a modest compost application, but more often than not a supplemental N source is required to maximize yield. While certain organic waste products (fishery wastes, feather meal, etc.) can be successfully used, their very high cost and limited availability are practical constraints. For organic production in cool weather, the added issue of reduced N mineralization rates from these products is an added factor favoring a readily available N source.

b) detrimental aspects of soluble nitrate fertilizers

While nitrate fertilizers have been correctly identified as a potential water pollution hazard, appropriate management (timing, rate, and application method) can significantly reduce this hazard. Limiting sodium nitrate use to 20% of crop N need (as has been the use restriction for sodium nitrate in organic culture in the U.S.), and applying the material just prior to rapid crop uptake, are reasonable safeguards to minimize off-site nitrate movement. I should also point out that the widely held belief that organic practices effectively eliminate nutrient leaching losses is a fallacy. Following the incorporation of a legume cover crop a significant amount of nitrate-N can build up in the soil profile; if rain or excessive irrigation occurs before the rapid crop N uptake phase much of this nitrate can be leached. Also, I have personally observed fields in long-term organic culture that have exceedingly high soil P levels, the result of annual manure compost applications, mostly made to supply N. Potential P loss in runoff from these fields is greater than for most conventionally-farmed fields. There is no credible evidence that a modest application of nitrate-form N would detrimentally affect the soil biota.

c) adverse effect of sodium on agricultural soils

At the low seasonal application rate suggested in this booklet (50 kg N/ha) the sodium contained in the fertilizer would have an insignificant impact on the soil system under most field conditions; the exceptions are duly noted in the booklet. The positive effect of sodium application cited for sugar beet is an unusual case; in almost all cropping scenarios the sodium would have no beneficial effect.

d) human health risks of increased nitrate concentration in produce

While heavy fertilization can result in undesirable high nitrate content in produce, specifically in leafy greens, my experience is that this is an infrequent problem, even in conventional culture. The U.S. currently has no national standards for nitrate concentration in produce, but my research has shown that conventionally-produced greens (lettuce, spinach, celery) seldom exceed the prevailing E.U. standards for nitrate concentration. Modest application of sodium nitrate in an organic system would represent much less nitrate availability than is typical in conventional culture.

For all these issues my experience agrees with the information put forward in this booklet. To the concerns over whether sodium nitrate represents a sustainable resource, causes environmental degradation in its mining and processing, or is in keeping with the organic philosophy, I have no particular expertise, and cannot comment of the validity of the case put forward.

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Book Review

Natural Nitrogen Nitrogenous Rock
Use of Natural Sodium Nitrate in Organic Farming. 2004.
H. Opdebeeck, G. Verhelst, E. De Marez, H.Tejeda, M.Van Hyfte.

This is a well laid document of 6 Chapters, including more than 174 references, 30 Tables, and 46 Figures. It is a comprehensible report to provide a complete integrated view coming from interdisciplinary approaches in order to bear witness to present Natural Sodium Nitrate as a source of nitrogen (N), in accordance with the criteria and principles of organic agriculture.

In general, the document is well presented; many important topics are precisely remarked. As expected, there is some overlap in material, but this is excused because the same topic is treated through different perspectives.

It is indeed a comprehensive and refreshing overview of Natural Sodium Nitrate (NSN) value as a rational fertilizer to complement the effects of organic sources which support organic agriculture. In general, it is an extended well supported version to be presented to the Codex Alimentarius Committee on Food Labeling. In the largest Section N° 1, about 45% of the document, brings us solid support to understand that NSN is a natural substance from geological origins.

Any item related to crop quality, yield, and life-enhancing effect is described through many examples derived from research obtained in different countries. It is derived from this review that during critical stages of growth, N as NSN will cover insufficiencies of organic N supply. The fact that N release coming from any organic source should be always subjected to temperature, and other environmental factors, is a universal reality.

It can be concluded that the use of NSN is a valuable complement to the organic sources of N in organic farming systems. As a matter of fact, split applied NSN can be synchronized with crop N uptake in order to produce best results in terms of yield, crop quality and protection to the environment through minimize any damage from leaching process.

In Section 2, it is clarified that through production of Natural Sodium Nitrate, no chemical transformations occurred, not even ion exchange is used, which is considered a unique case among mineral fertilizers, even including those used in organic agriculture.

As it is interpreted through Section 3, this section is a step-by-step synopsis of considerations and impact on the environment. NSN as compared to other fertilizers as phosphate rocks or different organic sources is one of the least contaminant nutrient sources; presence of heavy metals are of no real concern. From a positive point view, this natural nitrogen source is a unique carrier of trace metals that can benefit crop growth, which is also distinctly from synthetic nitrates.

It is an honest approach where beneficial and negative effects of NSN are analyzed. For example, there are no negative effects on soil structure and aggregation if some boundary conditions are carefully considered and avoided, for instance poor internal drainage condition in the soil, limited rainfall, etc.

Also, impact on microbial biomass is analyzed through the interaction of organic matter, and soil pH. Many effects are based on long-term experiments and farming practices.

Ecological impact through NSN application can be very favorable for crop growth if "good criteria" is used. As a matter of fact, "good general practices" should be performed for any fertilizer recommendations. And the recommendations should ever be developed following well known and accepted technical principles.

According to Section 4, related to human and animal health and quality, there is a broad recognition that NSN components as iodine, and sodium are helpful elements for livestock and human metabolism. Also, sodium exerts beneficial effects on many pastures and some other plants through physiological effects such as cell turgor and partial substitution of potassium.

Nowadays, there is no confirmation link between N concentration and cancer risk and many other environmental factors can determine nitrates content in plant tissues.

In Section 5, it is recognized that there is socio-economic factors and ethical values in the use of NSN. Many terms as self-reliance, sustainability, and others related to human way of life are strictly respected.

After reading this report, we are able to recognize the amazing reality that there are many areas of knowledge which are still not covered in this topic. For example the fact that there is no reason to study the soil-plant system as separates entities, because the close association between both at the interfaces of the lithosphere, and how this biodynamic entity react when a natural compound such as NSN is interacting.

Wealth of references at the end of the chapters appears, suggesting areas for future research related to this topic.

In general, the document should satisfy the needs of the organic research community as well as of ecologists, plant physiologists, and soil scientists.

I consider that it should be on the shelves of all university libraries. It is also a useful report for researchers in soil and plant sciences. It is an approach to consider NSN as a useful component for sustainable husbandry.

Carlos Rojas-Walker
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TAB 6

NATURAL NITROGEN

Use of Natural Chilean Nitrate in Organic Farming

by H. Opdebeeck, G. Verhelst, E. De Marez, H. Tejeda and M. Van Hyfte

Reader: Prof. Em. Dr. Ir. K. Vlassak

This book "*Use of Natural Chilean Nitrate in Organic Farming*" emphasizes in a positive way the importance of sodium nitrate as a valuable contribution for successful organic farming.
It is based on sound scientific data obtained in field trials and farming experiments. The book explains very well the role of Natural Chilean Nitrate in improving food productivity of high quality and maintaining soil fertility without any negative effects on the environment.

The contents of the book is well thought-trough and follows a logical order. The discussion is not limited to the dynamics of nitrogen in soil-plant system and impact on the environment, but also includes the natural way of production of Natural Chilean Nitrate, aspects of human and animal health and quality, as well as socio-economic aspects.

Sodium nitrate is obtained as a natural product from salt beds in Chile and can be an important source of inorganic nitrogen in organic farming systems. The book clearly points out that Natural Chilean Nitrate is a natural fertilizer and that it is the only natural source of nitrate nitrogen. This is a very important aspect because nitrate is mobile in the soil and is readily available to plants. In other words it has the same properties as nitrate nitrogen derived from the biological mineralization process when organic matter is nitrified.
This book nicely illustrates that the "caliche ore" is from natural origin. It only undergoes physical processing at low temperatures to extract Natural Chilean Nitrate without the use of chemical transformations, which is unique among mineral nitrogen fertilizers.

One of the major challenges in organic farming, using mainly farm yard manure or compost as a nitrogen source, is the synchronization of nitrogen release with the plant growth cycle and the period of high nitrogen need. It is quite clear that many of the constraints on organic yield arise because soil nitrate is not present in sufficient quantities to permit optimal crop production when needed. Natural Chilean Nitrate can overcome this constraint as it is readily available in the soil. Therefore it can be concluded that Natural Chilean Nitrate is a very valuable complement to bridge the critical shortage in nitrogen supply if properly used.
This is explained in the book in depth and supported by data from well documented trials.

In addition, Natural Chilean Nitrate contains, because of its natural origin, a range of useful trace elements often lacking in synthetic fertilizers.

The discussion of environmental aspects focuses on the impact of Natural Chilean Nitrate on soil structure and aggregate stability, maintaining soil fertility, leaching of nitrate and the presence of heavy metals.
As an alkalising nitrogen fertilizer, Natural Chilean Nitrogen should stimulate microbial biomass and biological activity in soil.

Without doubt Natural Chilean Nitrate can be recommended in organic farming systems as a very valuable nitrogen source to guarantee an adequate nitrogen supply during plant growth. In summary, this book provides useful information to produce high-quality fresh food using Natural Chilean Nitrate in organic farming systems without any negative impact on the environment, if properly used.

As a general conclusion: the use of Natural Chilean Nitrate together with organic nitrogen sources in organic crop production is in accordance with the principles of organic farming. It is a natural product, not subjected to chemical treatments, and it is environmentally friendly when properly used as mentioned in this book.

Furthermore, I was very pleased by the effort of the authors to support their claims by sound scientific data and to discuss their findings in relation to the most recent literature.

Prof. Em. Dr. Ir. K. Vlassak

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Review

Opdebeeck, H., Verhelst, G., De Marez, E., Tejeda, H. Van Hyfte, M. 2004. Use of natural Chilean Nitrate in Organic Farming Natural Nitrogen, Nitrogenous Rock, Chamoson, Switzerland, 152 pp.

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Introduction

Opdebeeck et al. (2004) discussed the possibilities of the application of Chilean Nitrate in organic farming. Their conclusion is that there are no grounds to refuse the allowance for the application of Chilean Nitrate in organic farming. Moreover, Chilean Nitrate applied as additional fertilizer will contribute to the sustainablility of organic farming. Some of the arguments are discussed in this paper. This review is drawn up from the perspectives of the authors' expertise, which lies within the scope of plant nutrition and fertilisation in intensive horticulture and protected cultivation. The emphasis will be laid on section 1 and 3, and to less extent to section 4 and 5.

Role of Chilean Nitrate in N-dynamics

A main issue of Opdebeeck et al., 2004 is the potential role of Chilean Nitrate to complement the N-supply from manures and composts in organic crop production. In the first place the problem of the synchronization between N-supply from organic fertilisers and the N-demand of the crop is considered (sections 1.1.1 and 1.2.2). This problem comprises a real bottle-neck in organic farming, as is discussed often (Bokhorst and Oomen, 1998, Koopmans en Willems, 2001). Even in case of long-term yearly supply of compost and or additional manure, the N-release is insufficient and divergent from crop demand (Koopmans et al., 2000; Voogt and Klein-Buitendijk, 1998).

Specifically for protected cropping this problem is serious and was the motive for a number of research projects, trying to solve the problem. In case of organic glasshouse horticulture very high inputs of manures were practiced (Voogt, 1999). Nowadays the input is limited by the EU-nitrate directive, to maximize N-input from animal manures to a maximum of 170 kg N ha^{-1} yr^{-1}, so growers have to use large amounts of compost instead. However, to fill the gap between supply in time and the actual crop demand, high inputs of additional fertilisers are then necessary. Animal by-products, like blood - , feathermeal and to less extent hoof and horn-meal are mainly used for this purpose (Koopmans and Willems, 2001) . This is undesirable and questionable indeed, as was mentioned in section 1.4. In the first place because of the source of these products, which is mainly the intensive husbandry. Secondly, the added value of the organic matter in the fertilisers mentioned does not contribute to a sustainable soil food web of microorganisms and it does not contribute to the maintenance of soil organic matter (Koopmans en Willems, 2001). Therefore the use of these type of fertilisers is under discussion by the organisation of organic producers (Kloen, 2000)

The perspectives of some specific organic fertilisers, which are of plant origin (plant extracts, malt, alfalfa) are somewhat underexposed in Opdebeeck et al., 2004. These fertilisers, with a relative high nitrogen content and relative fast mineralization rate have proved to be suitable to use as side dressing for protected crops (Marcelis et al., 2003). Nevertheless it makes sense to consider Chilean Nitrate as an additional N-source too, as it has readily plant available nitrogen.

Nitrogen losses

In Opdebeeck et al., 2004, attention is paid to the nitrogen losses, connected with temperature, soil moisture content and pH (sections 1.2.2.1 – 1.2.2.3). In protected cultivation, this is of less importance, since these factors are better under control. Moreover, in contradiction with open field crops, with high losses of nitrogen in autumn and winter because of leaching (page 49), in protected cultivation, the the N-loss by leaching could be minimized maximal. This is the actual strategy of organic growers who adjust the irrigation to the crop needs in order to avoid emission of N and P to the environment as much as possible (Kloen, 2000; Koopmans et al., 2001). However, the necessary high input of fertilisers in these intensive cropping systems on the other hand causes a potential risk of N-loss by denitrification. The process is closely related with the soil moisture content naturally, but also with the quantity and type of organic matter. As found in recent studies, the denitrification rate from the organic fertilisers applied could be substantial (Marcelis et al., 2003) . In Opdebeeck et al., 2004, this potential loss is not mentioned. If Chilean Nitrate will be permitted to be used as an additional fertiliser, the quantity of organic inputs could be better adjusted to the needs for organic matter than determined by the nitrogen demand. Consequently Chilean Nitrate will help to reduce N losses by denitrification.

Other minerals

Impurities, or in other words: the presence of other nutrients and minerals in organic fertilisers are mentioned and discussed in section 1.1.2. With good reason it is mentioned that this presence could be seen as an advantage over mineral fertilisers, since less other fertilisers are necessary for compensation. However, in Opdebeeck et al., 2004 it is not mentioned that the presence of other principle plant nutrients in organic fertilisers also could lead to an unbalanced mineral supply and so to accumulation. This is due to the fact that all organic matter is principally from plant origin, containing all the necessary plant nutrients. Due to relatively higher losses of N than of other minerals during the processes of conversion (animal fodder - manure or composting process), the rate of N to other minerals in most organic fertilisers is lower than desired for plant nutrition. And so an adequate N-fertilisation will lead to an overdose in K, P, Cl SO_4 etc. Especially in protected cultivation, with a minimum of leaching, accumulation of minerals will be substantial, as has been shown by Voogt, 1999. For P it will lead to dramatic high P levels and P-saturation in the soil. So it is absolutely necessary to keep watch over the balance of input and output of all minerals. For protected cultivation, additional specific nitrogen fertilisers play an important role in filling the gap between input and output in which Chilean Nitrate could play an important role in this situation.

A problem is the presence of Na in Chilean Nitrate. In Opdebeeck et al., 2004 the probable negative effects are discussed (section 1.1.2.3, 3.1.2.2). Towards the positive effects, the negative effects must be mentioned as well. In protected cultivation, too high Na input could lead to salinity problems (Sonneveld, 1988). As a consequence, the quantity of Chilean Nitrate to be used in protected cultivation is limited. This is also the case for manures and composts which are sometimes high in salt content as well particularly when expressed per unit of available net absorbed N.

In Opdebeeck et al., 2004 the issue of the use of additional fertilisers in organic farming according to the EU regulation is mentioned in relation to S-deficiency. In addition it should be mentioned that also for K and

Mg additional mineral fertilisers are possible. In chapter 2.6 of Opdebeeck et al., 2004 it is made clear that the impact on the environment of the production process of SOP, MOP, Kieserite and Epsom salt is considerable higher than for Chilean Nitrate. Moreover, in contradiction with the production of SOP and Epsom salt, for Chilean Nitrate, there is no chemical transformation of the mineral, nor is it an energy intensive production process. From this point of view there should be no objections against the use of the natural mineral fertiliser Chilean Nitrate in organic farming.

Final remark

As it is stated in the introduction in Opdebeeck et al. 2004,, there are several visions on organic farming and this determines how the use of Chilean Nitrate should be judged. The official EU definition contains the issue that organic farming aims at a sustainable ecosystem. Important themes are: renewable sources and recycling and next to this: farm management aiming at low environmental impact. These aspects are in contradiction to some extent. Strong emphasis on closing the cycle is in contrast with low environmental impact (Tinker, 2001). As it is described above, organic farming under protection, if carried out with maximizing renewable sources and recycling, potentially could lead to potential high losses of minerals and insustainable effects as for instance P accumulation. An accurate use of natural Chilean Nitrate as an additional fertiliser will definitely contribute to reduce some of the negative aspects involved in the N cycle and as a consequence will increase the sustainability of organic farming.

Naaldwijk, August 23, 2004.

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BOOK REVIEW.

September 14, 2004.

Natural Nitrogen Nitrogenous Rock
Use of Natural Chilean Nitrate in Organic Farming. 2004.
H. Opdebeeck G. Verhelst, E. De Marez, H. Tejeda, M. Van Hyfte.

The contents of this book, consisting of 6 chapters, presenting 30 tables, 46 figures and 174 references, can be briefed as follows:

This has reviewed that the basic princple of organic farming which is not applying any synthetic fertlizer or other agro-chemical product, but rather based on crop rotation, growing legume crops, applying crop residues, etc. to obtain satisfactory quantity and quality crop. This book reveals the possibilities for use of Natural Chilean Nitrate(NCN) to improve quantity and quality of crops disclosing all the problems related to organic farming, presenting practical examples and the literatures. It is concluded that the use of NCN is valuable complement to the organic sources of nitrogen in organic farming systems, considering fulfillment of some requirments, such as correct ammount and timing to be used as side-dressing in organic farming. In practice, split application of NCN can be syncronized with crop N uptake to produce best results in terms of yield, crop quality and protection to the environment.

Section 1. It is shown that organic farming is less performing than conventional farming in Europe and U. S. A. because of lack of syncronization between applied organic N and the crop need for N. This problem can be solved by side-dressing the mineralized soil N with NCN applying correct ammounts and timing. The presence of sodium, iodine and other trace elements have a positive effect on crop quality. The necessity of combining N mineralization with N side-dressing is explained illustrating a number of fertilization examples.

Section 2. The difference of NCN mining is clarified, comparing with other element minings, that no chemical reactions, such as ion exchange, in the mining of NCN are involved, and that the potential environmental effect is minimun, showing better than potash or rock phosphate mining.

Section 3. It is proven that NCN is one of the least contaminating fertilizer and

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NCN does not acidify the soils. It is evident that the mineralization rate of organic compounds, N availability and N efficiency are crucial factors in the maintenance and even increase of the soil fertility in the long term. The stability of the soil PH is critical and soil acidification should be avoided. It is also clarified that there are no negative effects on soil structure and aggregation if some conditioms are carefully considered and avoided, such as poor drainage condition in the soil, limited rainfall, etc.

Section 4. It is indicated that NCN compounds, such as iodine and sodium are helpful elements for animals and human bodies. The application of nitrate will not lead to ground and surface water contamination.

Section 5. It is mentioned that there is also socio-economic factors and ethical values in the use of NCN in broad. It is discussed on the characteristics of organic farming and on the role of NCN whitin this agricultural activity.

Section 6. It is mentioned that NCN, as natural non-synthetic products, offers a unique possibilities to improve quantity and quality of crops in organic farming considering the some condition of dosage and timing.

This book is well organized the topics and wirtten. It deals the various problems related to organic farming, and it concludes the possibilities for use of NCN to improve quantity and quality of crops presenting practical examples and the literatures.

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Date
Sep. 17, 2004

Book Review

Natural Nitrogen-Nitrogenous Rock
Use of Natural Chilean Nitrate in Organic Farming
by H. Opdebeeck et al.

This publication has the aim to understand the use of Natural Chilean Nitrate(NCN) for Organic Agriculture(OA). Also the materials are focused to the IFOAM "Criteria to Evaluate Additional Inputs to Organic Agriculture".

In Section 1 : "Natural Chilean Nitrate Is Essential and Necessary", the materials(tables, figures and explanations) pointed out the comparison of yield and quality of some crops between conventional and organic farming. Also, sodium in NCN may raise the yield and substitute potassium in the plant metabolism. In addition, sodium has the positive effects on the quality of some crops. The authors indicate that sodium is an benefit element in the crop products.

In conclusion, NCN provides the efficient available NO_3-N as a source of organic-N. The NCN contributes to the yield and optimal quality in synchronization with crop requirement of nutrients.

Therefore, the control of synchronization of soil N availability and requirement of the crops is the responsibility of cultivating managers-farmers. The right dosage and correct time to treat the NCN to crops should be the essential preconditions.

Section 2 : "Natural Way of Production of Chilean Nitrate". The caliche ore as a N-rock is formed by natural origin and physical processing at very low temperature to extract NCN. Mining, extraction, crystallization and solar evaporation system are environment friendly. This means NCN should be used to OA as an natural source. It is reasonable that NCN is unique fertilizer to use in OA in the view of the Table in page 89.

Section 3 : "Considerations and Impact on the Environment". NCN supports to maintain and increase long term fertility of soils and minimize all forms of pollution such as NO_3-N, perchlorates and heavy metals(Cd, Cr, Pb).

Through the comparison of NCN and $(NH_4)_2SO_4$ for 80 years(Table 18), it has been proved NCN could rise the productivity and convert to the healthy soil. It is understandable that NCN may have a positive effect on soil structure and aggregate stability, a very valuable complement on the N influx and controllability, an ecological impact, and biological cycles.

But NCN does not effect on the contamination of the soil or crop products by harmful materials. The overall score in page 123 pointed out the above results.

Section 4 : "Human and Animal Health and Quality". Nitrate, iodine, and sodium provide the positive health effect. Groundwater and surface water will not be contaminated by the use of NCN in properly amount and cropping time.

Section 5 : "Socio-economic factors and values(ethics)". The authors discussed the relationship between organic farming and effects of NCN in the organic agriculture. Also, they emphasize that NCN provides a valuable contribution to the OA, crop productivity, sustainability, best quality, a fair deal for consumers and promotion of local labor intensiveness, and national self reliance.

In the last Section 6, "Matrix Evaluation of Substances against criteria" is mentioned. The NCN should be a unique material to be used to OA, because it is natural source, non-synthetic products, harmless substance without the possibility of contamination by any chemicals or heavy metals.

The NCN in a natural source of nitrate nitrogen fertilizer contains 16% N, as an available form. The effect of the N is variable depending on the temperature, humidity, pH, soil fertility, soil microorganism, and other environmental factors.

But it is necessary to investigate the influence of Na on the soil dispersion, which physical soil conditions may be down, if excess Na is accumulated in the soil.

In my opinion, it will be much better understanding of NCN, if the experiment of NCN treatment is more detail.

The publication-Natural Nitrogen is very good and reliable materials including experimental tables, figures and overall scores. The formation of the book is systematic organization. The explanation is easy to understand what OA is and the role of NCN in OA is.

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TAB 7

1 REPLY TO THE 2004 IFOAM EVALUATION OF NSN "IFOAM 2004"

1.1 Introduction

All argumentation against NSN can be countered effectively and convincingly by referring to the document "Natural Nitrogen, Nitrogenous Rock" (NNNR) which is based on solid scientific references of which the most important come from reputed, peer reviewed and published research some of them carried out by organic agriculture research stations.

Besides referring to publications like TAP[1] reviews, the replies to the IFOAM 1989 and 2004 evaluations are therefore mostly based on this afore mentioned document.

[1] TAP: National Organic Standards Board Technical Advisory Panel for the NOP (National Organic Program) of the USDA (United States Agricultural Department) USA.

To facilitate the reading of the corresponding replies the IFOAM comment has been subdivided into numbered paragraphs.

ARGUMENT 1: The principles state that the 'fertility and biological activity of the soil should be maintained or increased, where appropriate, by cultivation of legumes, green manures or deep-rooting plants in an appropriate multi-annual rotation program; incorporation in the soil of organic material...'

We fully agree with this statement.

ARGUMENT 2: Specific substances may be applied 'only to the extent that adequate nutrition of the crop or soil conditioning are not possible by [these] methods.' (Codex Alimentarius GL 32-1999, rev 2001, Chapter Annex I Principles of organic production point 5).

It has been shown that adequate nutrition of certain crops with fertilizers derived from (non-hydrolyzed) animal or vegetative wastes is not possible at all under some climates or some critical conditions. This inadequate nutrition leads not only to yield deficiency but also to produce of insufficient quality.
(Hydrolyzing those wastes turns them into a synthetic fertilizer which use is directly counter to organic principles).

ARGUMENT 3 Sodium (Chilean) nitrate application is directly counter to these principles because it contains no organic matter, and because it is possible to obtain adequate nutrition of crops from organic material without the application of sodium nitrate.

Besides increased consumer expectations what happened is that over time it was noticed that new high performing plant varieties could not be nourished in the same way as their low-yield ancestors, if yields and quality close to their potential (within organic farming restrictions) were expected. On the other hand compost, for example, is considered the best producer of humus but unfortunately it is not a good producer of N. Therefore a solution had to be found and apparently was found in the form of animal refuse like blood meal, bone meal, feather meal, feather meal etc.

However a closer look shows that instead one problem had been replaced by a string of other real or potential problems without bringing any "organic" benefit.

- Animal refuse does not produce humus. One of the basic and most important principles of organic production is the maintenance of an adequate rate of humus (unstable and stable) that in turn maintains and stimulates biological life throughout the vegetative cycle and maintains soil structure, etc. Fertilizers of animal origin do not leave any humus and their "episodic" uses will not more or not less stimulate bacterial life than Natural Sodium Nitrate(NSN) (which does not mean they don't).

[1] For more background information, references and bibliography we refer to the book "*Natural Nitrogen, Nitrogenous rock*" (to obtain this document send an e-mail to info@naturalnitrogen.com or download from the web site www.naturalnitrogen.com) and the document "*The Use of Natural Sodium Nitrate Compared to Authorized Animal Waste Products*" which also can be obtained by sending an e-mail to info@naturalnitrogen.com.Further information like "*Comments and Reply to IFOAM's Evaluations (1989) of Natural Sodium Nitrate (NSN)*" and a copy of this document can be found on the same website.

- Further, when hydrolyzed-and many are indeed hydrolyzed- fertilizers of animal or vegetative origin don't even produce soil organic matter (SOM).
- They represent the following drawbacks:

  - Hygienic problems: blood, bone and meat meal are prohibited in many countries in Europe and Japan because of BSE transmission risk. Recently Canada with the support of IFOAM proposed to prohibit cattle wastes as fertilizer at the Codex session at Montreal, 2004.
  Feather meal recently is presenting a similar and potentially an even worse problem: Avian flu, A(H5N1) virus, contrary to BSE is relatively easily transmissible to animals and people and is just as lethal. Fish meal mostly contains high levels of PCB's.
  Anthrax, a widely spread deadly bacterial cattle disease, can be acquired by animals and humans thru animal wastes like leather. (More information on the health issue regarding animal waste fertilizers can be found in the document "The Use of Natural Sodium Nitrate Compared to Authorized Animal Waste Products", available by e-mail to info@naturalnitrogen.com).

  Instead NSN is used since more than 100 years and never gave any health problems whatsoever. Therefore it certainly satisfies amply the Principle of precaution so dear to organic farming.

  - The traceability of organic wastes in general is doubtful. Indeed those wastes don't necessarily have to come from organic farms. Therefore contaminants like antibiotics and hormones. might be introduced in the system.

In short, wouldn't it be much more straightforward and consistent to simply adhere to the principle that has been applied since the birth of organic farming i.e. complementing organic vegetative amendments with natural minerals (soluble or not) when really necessary and this for all nutrients including N and not only for P,K and Mg?

It is also noteworthy that, despite the fact that the N and S-cycles are very similar and that nitrate and sulphate act in similar ways, mineral S ($S^{=}$ and $SO_4^{=}$) fertilizers are authorized even though organic S sources are abundant.

Further the TAP[2]-review on Chilean nitrate, page 6 is referred to:
"*Smith (1992) determined that the nitrogen release curve for a combined cover crop/feather meal amendment was inadequate to supply late-season nitrogen demand in bell peppers*".

In the same TAP-review, page 9 is quoted:
"*[If Chilean nitrate is disallowed], it seems inevitable that an alternative source of fertilizer N with predictable nitrogen release characteristics will have to be found [but hasn't been found yet].*"

ARGUMENT 4: Organic material that contains nitrogen enhances soil fertility for a longer period of time, and stimulates biological activity more than sodium nitrate.

First a distinction has to be made between N carriers like compost and manure which are basically "soil amendments" and quick acting N sources like animal wastes which are classified rather under so called fertilizers i.e. short term N suppliers.

1.N carriers as soil amendments.

[2] TAP: National Organic Standards Board Technical Advisory Panel for the NOP (National Organic Program) of the USDA (United States Agricultural Department) USA.

In this ARGUMENT 4 it is stated *"Organic material ... stimulates biological activity more than sodium nitrate":* This seems to be considered an advantage.
However, in this same document ARGUMENT 17 is mentioned: *"A nitrate fertilizer ...* increases the metabolic rate *of soil microbial biomass that in turn accelerates the mineralization of soil organic matter";* this seems to be considered a disadvantage.
Therefore stimulating biological activity (metabolic rate) is considered beneficial and the contrary at the same time. This is one example of a contradiction in this document.

Similar contradictions where also found in the TAP-review on Chilean nitrate, Criterion 5, page 5: *"Additions of soluble nitrogen increases carbon mineralization rates, which may lead to a decrease in soil organic matter": this is considered a* disadvantage.
However in the TAP-review on synthetic potassium sulphate, Criterion 6: *"However, potassium sulphate has several advantages over potassium chloride ... in podsolic soils ... potassium sulphate had a stronger effect on the mineralization of organic compounds".*

And in the TAP-review on synthetic potassium sulphate, reviewer 3 states: *"Criteria 1-5 are not relevant to this case. But this does not in itself qualify a substance for inclusion. It is not necessary for something to be grossly or subtly toxic or ecologically damaging for it to be inappropriate to organic agriculture. We could name several synthetically derived nitrogen fertilizer sources, for example, which if used in moderation, might not be harmful, and might in fact stimulate biological activity in the soil, yet these are clearly and unquestionably disqualified for inclusion on the National List [exactly because they are synthetic]"* (by the way but this is not the point here, the natural origin of mineral fertilizers is considered here as a very important criterion).

On the first sight these are indeed contradictions. But this may not come as a surprise: an organic soil amendment is exactly that: "an amendment" and therefore not always a reliable N supplier.

Further long-term experiments like the Broadbalk Continuous (>140 years) Wheat Experiment, Rothamsted, UK have showed that soils that received inorganic fertilizer contain more microbial biomass than soils from the corresponding plot that have not received inorganic N (Shen et al., 1989).
Studies at the same site carried out by Glendining et al. (1996), confirmed that different rates of inorganic N fertilizer (48, 96,144 and 192 kg N/ha since 1852) had no effect on the soil microbial biomass N or C contents though there was some positive correlation with the specific mineralization rate of the biomass contents (defined as N-mineralized per unit of biomass). Although the size of the microbial population appears unchanged, its activity was greater in soils receiving long-continued applications of mineral N fertilizer.

2.Quick acting N-carriers

Faster acting N fertilizers like feather meal, bone meal, blood meal, etc. are only acting fast because they contain *"substantial amounts of mineral N"* (TAP review on Chilean nitrate, page 7) or because they are hydrolyzed. Indeed their episodic introduction is insufficient to maintain microbial life which is one of the goals of organic agriculture.

Further NSN stimulates very well microbial life but in an indirect way through increased biomass (yield) and through synergy with organic fertilizers.
Indeed the highest biological activity is obtained with the combination of organic fertilizer and (pH increasing) complementary mineral fertilizer like natural Chilean nitrate. For example earthworms: research by Edwards and Lofty (1982) at Rothamsted, and other research papers quoted by Lampkin (2002), found that plots receiving both organic and mineral N had the largest population of earthworms.

Also following quote from the TAP review on Chilean nitrate, page 7 is referred to: *"If used in moderation, none of these nitrate-containing materials [Chilean nitrate, potassium nitrate, etc.] would have serious detrimental effects on the soil biota. The presence of significant quantities of nitrate in organically managed soils is not unusual; following the breakdown of a legume cover crop, a buildup of 10-20 mg/kg NO_3^--N is common. Manure-based compost may also introduce substantial nitrate (NO_3^--N) when irrigation is inefficiently managed".*

ARGUMENT 5: While certain specific mineral fertilizers may be used to supply nutrients that are otherwise depleted, soil micro-organisms dissolve these nutrients first. In organic agriculture one of the basic principles is to fertilize/nourish primary the soil and not directly the plant. In contrast, sodium nitrate is immediately soluble without being digested by soil organisms.

However the **intended use** of NSN (and of all quick (already authorized)acting N-carriers for that matter) in organic agriculture should be to improve N-efficiency and decrease N losses during some critical growing stages and by the same token improve crop quality and yield. At these particular growing stages this can only be achieved if that N source is plant available and thus present in the soil solution. Therefore solubility is **essential** in this context.

Further potassium sulphate, magnesium sulphate, patentkali, sodium chloride and other nutrients like micro-elements in the form authorized in organic farming are *"immediately soluble without being digested by soil organisms"*.

ARGUMENT 6: Some papers indicate that sodium nitrate has no effect, either beneficial or adverse, on soil organism populations. However, studies show that soluble nitrogen fertilizers simplify soil ecology and reduce biodiversity of soil organisms.

Regarding the first part of this paragraph, we refer to the comments on ARGUMENT 4 of this document.
However no documented support for the second part has been found yet (of course when, as repeatedly said, NSN is used as intended). The reply on ARGUMENT 4 and ARGUMENT 5 on the contrary discredit this comment.

As mentioned before it was never the intention to replace organic N fertilizers with NSN but only to use as a complement. Complementary use of NSN will be a very positive contribution to soil organism populations. Long term research suggests an even greater contribution than when exclusively organic fertilizer would have been used.

ARGUMENT 7: In particular research has shown that applications of soluble nitrogen fertilizers in general and sodium nitrate in particular depress the activity of nitrogen fixing organisms.

NSN was never intended to be used in organic farming as sole source of N but only in harmonious complementary synergetic use with already authorized organic amendments using the strength of both types of input to bridge the critical nutritional N-gap.

In that case the activity of N-fixing organisms will not be affected because at that very moment it is exactly the activity of N-fixing organisms that is lacking and is therefore one of the causes of the N-gap instead of the effect. There should be no confusion between cause and effect.

Also N-fixing organisms live in symbiosis with legumes.
NSN is not intended to be used on legume crops.

ARGUMENT 8: The allowed mineral fertilizers are different rocks, natural rock phosphate, calcium and magnesium carbonate, gypsum and others. The nutrients are generally not in an easy soluble form. In case of Chilean nitrate the substance is a water-soluble extract of caliche; the rock used, and is not comparable with the hardly soluble rock phosphates and the other mineral fertilizers (see below).

Calcium and magnesium carbonate and gypsum are mostly used as soil conditioners and not as fertilizers.

Potassium sulphate, potassium magnesium sulphate (patentkali), magnesium sulphate, sodium chloride are all very soluble and are allowed organic fertilizers as well. On top, PK fertilizers are mostly used as base (buffer fertilizer) to be added to the large P and K pool already present in the soil. This is not the case for N which has to be applied at the most some weeks before planting and/or mostly as a side-dressing complement.

Side-dressings of P and K are not usual except sometimes in critical conditions. Under these conditions they are applied as leaf spray (as are micro elements and also sometimes quick acting N fertilizers in USA). Remarks could be made about the non-natural (non-organic) questionable way of application and the usage of those very soluble and synthetic fertilizers.

The TAP review on synthetic sulphate of potassium(SOP) states on page 6: *"Currently, the National List allows the use of naturally derived inorganic potassium salts in cropping systems. These may consist of K^+ in combination with Cl^-, SO_4^{2-}, NO_3^-, PO_4^{3-}, and $P_2O_4^-$. Sylvite, sylvinite, and langbeinite are the most common mineral K sources (Thompson, no date). These substances are highly soluble, and may be used in addition to green manures and composts when the latter are considered inadequate in terms of timing, form, or nutrient concentration. Sylvite is a mineral salt composed primarily of muriate of potash (KCl), and the refined substance contains 60-62 % K_2O ».*

The intended use of Natural Chilean Nitrate in organic agriculture(and of authorized rapid N release carriers for that matter) should be to improve N efficiency and decrease N losses during some critical growing stages and by the same token improve crop quality and yield. At these particular phenological stages this can <u>only</u> be achieved if that N source is plant available and thus present in the soil solution. Therefore solubility is essential in this context.

ARGUMENT 9: In organic farming systems, nitrogen is obtained from crop rotations that include nitrogen-fixing leguminous crops, free-living nitrogen fixing organisms, and the application of compost and manure.

This is agronomically correct and represents an ideal situation but unfortunately sometimes there is an important gap in the N-cycle. Due to a lack of synchronization and synlocation of the mineralisation of compost and manures with some critical growing stages, the N supply can be insufficient. The N-cycle cannot be isolated from other physical , chemical and nutritional conditions when considering agricultural production. Moreover a lot of N from organic fertilizer gets lost. Three main on-farm N-losses can be distinguished :

1. ammonium volatilization losses;

2. nitrate leaching, runoff losses and erosion;
3. denitrification losses through gaseous compounds.

The first and second type of losses are by far the most important in most countries (temperate climates) and represent for example over 85% of overall farm N losses that occurred in Switzerland during 1994 (Biedermann & Leu, 2003). Nitrate leaching from organic fertilizer (like compost and manure) is an order of magnitude (~10 x) greater than from mineral N fertilizer (Kirchmann & Bergström, 2001).Further In organic agriculture, crops that are exported from the farm are mostly not allowed to be brought back as municipal waste (because of heavy metals, hygiene, etc). The legume technique could in principle allow closing an important part of this N-gap, but is, as described above, in practice only partially satisfactory.

ARGUMENT 10: Plant and animal by-products can be used to provide supplemental nitrogen.

See ARGUMENTS 3 and 4 of this paper.

ARGUMENT 11: organic agriculture relies on "slow release" fertilizers by using less soluble mineral fertilizers, but also with the use of organic nitrogen fertilizers. Therefore, given the abundance and ready availability of such sources, Sodium nitrate is unnecessary and cannot be considered essential for its intended use.

The possibilities of side-dressing application in organic farming during the growing season are limited, because the organic fertilizers that are available are not suitable to close the N-gap at critical times due to their slow release characteristics (Zanen et al., 2003; Loiusbolk Insitute Wageningen, The Netherlands).

Complementary fertilizers as feather meal, bone meal, blood meal, etc are, at first sight, suitable as the nitrogen is relatively quickly released. (TAP-review on Chilean nitrate, page 7: *"... several common materials (blood meal, feather meal, and hydrolyzed fish powder, for example ... containing substantial amounts of mineral N.*

However they all represent one or more of the following deficiencies:

- Or their N is released too slowly (in the case of non-hydrolyzed animal or vegetative waste) and therefore do not satisfy the critical N- need of the moment.
- And/or they represent a serious health hazard (most animal waste products as blood meal, feather meal, leather meal fish meal and some vegetative waste products like ricinus cake meal)
- And/or they contain a high amount of nitrates which, when unknown to the user, may lead to wrong application rates or application timing (e.g. "liquid fish").

Further the use of NSN has other unexpected advantages and the TAP review on Chilean nitrate confirms this: page 9: *"There are other reasons for keeping the Chilean nitrate source in organic agriculture. Reduced tillage systems are currently being considered and would benefit all types of agriculture. Converting organic agriculture to reduced tillage would be difficult without a readily side-dressable form of nitrogen fertilizer. Composts and manures are difficult to sidedress with current technology. Chilean nitrate has similar physical properties to conventional nitrogen fertilizer preparations and therefore makes it amendable to be sidedressed. This would be especially important in vegetable row crop systems".*

ARGUMENT 12: Most sodium nitrate fertilizer is mined in Chile. The environmental impact is similar to that of other mined minerals.

The environmental impact is not similar to that of the mining and beneficiation of other mined minerals but is significantly more environment friendly compared to rock phosphate, potassium sulphate, kainite, rock potash, sylvinite, patentkali (potassium magnesium sulphate), kieserite, and Epsom salt (all authorized in organic farming).

Further non-renewable energy used is only around 40% of the amount used by synthetic N manufacturers and this for the same amount of N (SQM 2004, EFMA - European Fertilizer Manufacturers Association – 2004) . This will be improved even more in the near future.

ARGUMENT 13: Given the geographically limited reserves and isolated supply, the transportation of nitrogen long distances has a potential to cause greater adverse environmental impacts than most other mined minerals. In most areas in the world there are local resources available for the production of organic commercial fertilizers, however these might be more expensive or more complicated than manufacturing sodium nitrate.

All mineral resources are limited. This is also the case for potash, phosphate, maerl (calcified kelp), etc. The caliche rock in Chile will last for at least several more centuries. Also China is mining nitrogenous rock and other deposits have been discovered recently in Kazakhstan.

Regarding the environmental impact due to long distance travel, the following reflections should be made: Knowing that 1kg N produces at least 20 kg wheat (assuming average yields) (Finck, 1979), it may be much more environment friendly to import the fertilizer (by vessel) then importing the wheat.
Also the same reasoning can be made when choosing for example between flying in early vegetables (in crates and the crates in an air shipping container) by plane instead of a much smaller quantity of NSN in bulk by vessel.
Even when not considering environmental and sustainability criteria ("food-miles") and
other criteria included in the organic holistic approach, mere economic arguments call for the local production option (if all other economic parameters are equal).

Nevertheless in Switzerland for example, over 95% of organic cereals are imported from overseas (Swiss import export statistics, Direction générale des douanes, Bern, 2002). *"It would be worth to produce those cereals locally"* (Cahiers de la FAL 45, 2003; page 26). However for this better quality i.e. better protein content (baking quality) should be obtained i.e. better N nutrition.
In USA this same problem exists: experiments are conducted at Ohio State University for example on hard wheat production in an attempt to improve protein level and baking quality of organic wheat (contact Deb Stinner,OFFER).

ARGUMENT 14: Research has shown that crops fertilized by sodium nitrate will have significantly higher levels of free nitrate than crops fertilized with compost or manure. This effect is most pronounced in winter when fertilizing with pure soluble sodium nitrate is the only nitrogenous soil amendment. Sodium nitrate potentially increases the nitrate content in leafy vegetables such as salads. Although this risk must also be taken into consideration when using organic fertilizers, the unique use of Sodium (Chilean) nitrate in the spring which would be likely the case in practice, raises this risk.

Organic crops in general may indeed be lower in nitrate when compared to crops fertilized with heavy doses of mineral N. However taking into account the [recent] evolution in [conventional] agriculture practices, particularly for N fertilization and even more when nitrate is used only to cover certain critical crop needs as a complementary fertilizer and not as a unique N source, nitrate accumulation is not to be expected. Indeed the proposed use of Natural Sodium Nitrate is on a complementary base as part of a systemic approach.

Any fertilizer (mineral or easily decomposable organic fertilizers such as blood meal, bone meal, feather meal, bean meal, guano, ...) might increase nitrate accumulation especially with excessive application rates (Termine et al., 1987). Avoiding excessive use of any nitrogen source including organic amendments is exactly the aim of this complementary use and this as part of a systemic/holistic approach.

Referring to the TAP-review on Chilean nitrate on page 7: "*It is true that application of this product late in the crop cycle of leafy greens (the expected use pattern) would increase the nitrate concentration of the produce, but it would be very unlikely to result in levels deemed a health hazard by current standards. In my research on conventionally grown lettuce produced in the Salinas Valley, I have never found nitrate levels in the edible portion to exceed the standards set by the European Community, even in field situations where excessive amounts of synthetic fertilizer was used. Other researchers have found that conventionally produced California spinach occasionally exceeds these standards, but the likelihood of any organic production, even with the use of sodium nitrate, approaching or exceeding these standards is remote*". The intention is complementary use and certainly not "*excessive amounts*".

ARGUMENT 15: Nitrate will be reduced in the human body to nitrite, which has been linked to methemoglobinemia, a potentially fatal condition whereby nitrites interfere with oxygen uptake. Pregnant women and small children are at a particularly high risk from methemoglobinemia. Nitrites can also be further reduced to nitrosamines which compounds are strong carcinogens.

Former reply on ARGUMENT 14 makes this argument irrelevant even though the methemoglobinemia risk link to nitrates has been proved to be non- existing lately.

In any case it is worth mentioning again that the point of this document is to evaluate the use of NSN according to organic standards.
Limitations in the use of N in different forms (and converted into other different forms in the soils) is an issue pertaining to all sources of N (organic and mineral) besides being a theme belonging to food safety regulations in general.

ARGUMENT 16: Organic growers throughout the world have successfully developed systems that use compost, green manure, and plant and animal by-products to supply the nitrogen needed to grow all commercial crops throughout the year over a wide range of climates and soils.

This statement is not true and is rebutted by factual evidence obtained in field trials by research in organic agriculture in Europe and USA. See also all former paragraphs.

ARGUMENT 17: An organic fertilizing system is based on cultivation of legumes in a crop cycle with cash crops and green manure in combination with farmyard manure and compost where available. Such a system contains a balance of nitrogen and carbon sources, both of which nourish soil organisms that are essential for the cycling of nutrients. Carbon stabilizes the soil biomass and provides energy to soil organisms. Nitrogen is stored in the form of proteins that are slowly released by the biological decomposition of organic matter.

By contrast, sodium (Chilean) nitrate contains no carbon and supplies soluble nitrates in a simple form similar to synthetic fertilizers such as potassium nitrate or calcium nitrate. A nitrate fertilizer that lacks carbon creates a carbon: nitrogen imbalance that increases the metabolic rate of soil microbial biomass that in turn accelerates the mineralization of soil organic matter. The crop response and increase in soil fertility is short-lived.

Attention has to be drawn on the contradiction mentioned in ARGUMENT 4 which can be summarised with the question: have organic matter and organic fertilizer a dual or a single role i.e. soil amendment and N supplier or only soil amendment?
If they are also supposed to be nutrient suppliers in all circumstances, then they should be able to undergo sufficient mineralization at the moment when nutrient demand is present and critical. If not, N-fertilizer with available N should be added which preferably would stimulate mineralization itself.

Even if, when using NSN "... *increase in soil fertility would be short lived.*" - it was shown in former paragraphs that this was not the case because of increased return of crop wastes- the similar affirmation would then be true for quick acting (and quickly exhausted)N fertilizers like blood meal, bone meal, feather meal, etc which have a C/N of about 3, much closer to e.g. urea than to e.g. manure and compost with a C/N of 18 and 14 respectively

ARGUMENT 18: With organic commercial fertilizers it is also possible to get a higher mineralization in cold soils for vegetable growing in the early season. These commercial fertilizers are for example based on horn or feather meal, malt sprouts, fish meal, or bean meal among others. With these fertilizers it is possible to grow even heavy feeding crops such as cauliflower with products found on annex 2 in the early spring. Although such fertilizers are usually more expensive per unit of nitrogen and often more difficult to handle, they are nonetheless available alternatives that better maintain the long-run fertility and condition of the soil and are more suitable for crop rotations than sodium (Chilean) nitrate.

See comments on ARGUMENT 3 and ARGUMENT 10 of this document.

ARGUMENT 19: More research is clearly needed to improve the efficiency of organic sources of nitrogen, but this does not support the case that sodium nitrate is essential.

NSN is essential because in those critical nutritional situations it was shown that it represents a superior systemic approach than organic input.
One could agree with the first half of this paragraph but whatever research could achieve to improve the efficiency of organic sources, there is no indication that this will be possible in reality without drawing on artifices like hydrolysis.
Furthermore some deficiencies of organic amendments cannot be eliminated (except again trough e.g. chemical processes like hydrolysis and treatment with acids) and could create other problems e.g. the possible accumulation of associated nutrients (P, K).
See also TAP-review on synthetic SOP page 8, criterion 6.

ARGUMENT 20: The Chilean source fulfils the criterion of being a source of mineral origin without further chemical processing. However, sodium nitrate may also be synthesized by a number of processes (Collings, 1950).

No chemical transformations, not even ion exchanges, are used which is unique among mineral fertilizers including those used in organic agriculture. Of course "sodium nitrate may also be synthesized by a number of processes" (which is also is the case for potassium sulphate etc.), however this is not the case with natural sodium nitrate (natural Chilean nitrate).

"An essential difference between many natural and synthetic fertilizers is the degree of their purity. Farmyard manure contains not only nitrogen but also provides all necessary plant nutrients; Natural Chilean Nitrate contains many admixtures in contrast to synthetic sodium nitrate that is essentially a pure chemical. The trend to increase the purity of fertilizers is no justification at all for considering them to be harmful. But it does represent a potential danger to food quality because of a possible one-sidedness in fertilization. On the other hand a greater purity also ensures smaller amounts of possible detrimental admixtures" (Finck, 1979).

Following quote from the TAP-review on synthetic SOP: *"We could name several synthetically derived nitrogen fertilizer sources, for example, which if used in moderation, might not be harmful, and might in fact stimulate biological activity in the soil, yet these are clearly and unquestionably disqualified for inclusion on the National List [exactly because they are synthetic] ».*

This clearly says that synthetic mineral N-fertilizer should not be used and also says why natural N mineral fertilizer should be used.

ARGUMENT 21: Most of the sodium nitrate mined in the Atacama desert is processed into potassium nitrate, with iodine a significant co-product (USGS). A certain amount of chemical processing may take place to separate the iodine and remove toxic impurities such as perchlorates. At present, most of the beneficiation involves raising the potassium level and does not appear to be used to maintain the fertilizer guarantee levels in the sodium nitrate. However, products identified as 'nitrate of soda-potash', 'Chile salpeter', or 'niter' would not meet this criterion and should not be considered 'Chilean nitrate' even though they originate from Chile and contain nitrate.

The point of above statement is difficult to understand. As already mentioned NSN, also called Chilean nitrate, is obtained in Chile since about 150 years and this by simple concentration of the leached solution.
The sole beneficiation process evolution it has undergone over 150 years is increased concentration, purity and physical presentation (granulation).
(Note: "*Chili salpeter*" is German for Chilean nitrate).

ARGUMENT 22: Although only small amounts of sodium nitrate are known to exist at present, it is conceivable that another commercial deposit could be opened somewhere else in the world. "Chilean nitrate" implies that one nation should be given license to control an international monopoly over the production of a given input. For the purpose of clarity, the dossier should refer to 'natural sodium nitrate' and not 'Chilean nitrate'.

We assume that above statement refers to natural sodium nitrate in general and not only the one from Chile.
In China (Turpan desert, Xinjian province, North-West China) NSN is produced from rocks since several years. And recently nitrate bearing ore has been found in Kazakhstan.

ARGUMENT 23: Sodium nitrate accelerates the mineralization and depletion of soil organic matter, in contrast to organic nitrogen fertilizers that maintain and improve soil organic matter.

This together with ARGUMENT 17 is in contradiction with ARGUMENT 4, as mentioned before. This subject of mineralization has already largely been developed. It has been shown that natural sodium nitrate does not has a negative influence on soil organic matter but on the contrary through an indirect effect of increase yield and therefore increased amount of crop wastes returned. See also ARGUMENT 4, ARGUMENT 6 and ARGUMENT 7 above.

In the 40 year (1963-2003) experiment by Vuillioud et al. (2003), Switzerland, where three different farming practices (mineral fertilizer only, mineral fertilizer + crop residues and mineral fertilizer + farm yard manure) are compared: soil organic matter content was not significantly influenced by the three fertilization systems.
The Limburgerhof trial 8 (23 years) in Germany, (Jürgens-Gschwind & Jung, 1977) shows that a higher humus level is obtained when mineral fertilizer is added to manure: 1.70% against 1.94% humus.

The above long-term experiments results suggest that complementary use of NSN would not have a direct impact on microbial biomass as OM content would not be affected negatively. Moreover, only vegetative waste and then only when not hydrolyzed, can increase organic soil matter. Fertilizer produced from animal waste, as bone meal, feather meal, etc., does not increase soil organic matter (SOM), except indirectly through higher yields and consequently a larger amount of crop residues that stay on the field. The same can be said of Natural Chilean Nitrate.

ARGUMENT 24: Nitrate is highly mobile in soil. Nitrate that is not immediately assimilated by plants can be leached in the ground water.

In fact this argument is not relevant.
Indeed there still seems to be a believe or misunderstanding that nitrate in the soil is somehow linked solely to nitrate in fertilizers.
Therefore it may be worth to state once more the generally accepted scientific facts (1-8, 10) about nitrate as plant nutrient.

1) N (nitrogen) is the most important plant nutrient (after water, CO_2 and O_2).
2) N is for over 90% taken up by all plants as nitrate in conventional as well as in organic agriculture.
3) N-fertilizers are mineral or organic. (Organic in this sense means compounds that contain C.)
4) Plants practically do not take up any organic N compounds.
5) To be plant available (almost) all N in those fertilizers has to be converted in nitrate if not already in that form.
6) Pollution of groundwater (or well water) with nitrates and excess of nitrate in crops is due to excess use of N-fertilizers (mineral or organic) or synchronization problems.
7) For the same amount of N-input, leaching losses (as nitrate) and other N losses are mostly much higher from organic N-sources than from mineral N-sources.
8) The higher nitrate losses are mostly due to synchronization problems i.e. a time gap between plant nitrate needs and nitrate availability.
9) The intended use of NSN is not to replace nitrate from organic sources but to complement it in order to compensate this lack of synchronization.
10) This complementary use is one of the BMPs (Best Management Practices) to diminish nitrate pollution and at the same time will increase crop yield and quality.

[This latter paragraph has been added only in the English version of this paper.]

(See ARGUMENTS 8 and 9 of this document)

ARGUMENT 25: The salt index of Chilean nitrate is 100, which is higher than almost every other fertilizer (Rader et al., 1943). For most crops and in many areas, the addition of sodium

which can pose a problem in some areas. In irrigated regions or in greenhouses it is necessary to leach the sodium periodically "out of the system" to prevent the salinity of the soil. A higher consumption of water and a load of salt to the environment is the negative impact/consequence.

- Sodium soil concentration will remain well within their natural range when NSN is used as intended.
- From the TAP-reviews on synthetic SOP :

page 3, International certifiers: "*UN FAO Codex Alimentarius guidelines allow the use of "rock potash" and "mined potassium salts" which are "less than 60% chlorine.*" : But the most purified KCl-fertilizer (60% K_2O) contains "only" 48% chlorine. This would mean that the permitted chlorine level is unlimited.

page 4, criterion 2: "*By comparison, potassium chloride (muriate of potash) has a benchmark salt index of 116, higher than both sodium nitrate (100) and ammonium nitrate (105)*".

page 5, criterion 3 in Table 1: "Manure salts" (20%) have a salt index of 5.6 * 20 = 112

TABLE 1 Salt Index of some inorganic potassium fertilizers

Material	%P_2O_5	Salt Index per Unit of Plant Nutrients
Manure salts, 20%	20.0	5.636
Potassium chloride	60.0	1.936
Potassium nitrate	46.6	1.580
Potassium sulfate	54.0	0.853
Potassium magnesium sulfate	21.9	1.971

Adapted from Rader et al. 1943

Erratum: in above table, instead of P2O5, read K2O.

page 5, criterion 5: "*... sodium (Na+) is similar to potassium in its chemical properties, and has been shown to substitute partially for potassium in some crops (Thompson, no date)*".

page. 6, criterion 6: "*Sullivan and colleagues (2000) report that manures contain 0.6% salts on a dry weight basis, and that 20 tons of fresh manure would add 90lbs salt/acre*".

page 6, criterion 6: "*Unrefined sylvinite (KCl•NaCl) contains 20-30 percent K_2O*". [and 20-25% Na and 30-40% Cl] Sylvinite is an authorized natural mineral fertilizer. Magnesium-kainite also an authorized natural mineral fertilizer contains 20% of Na. NSN does even not contain Cl.

page 7, TAP reviewer 1, criterion 5: « *In this regard this product [SOP] is preferable to the use of manure-based composts, which have higher salt content (including chloride) per unit of K content. Use at reasonable agronomic rates has minimal consequences on soil salinity*".
This statement is even more true (expressed per unit of nutrient) when accounting for all relevant data: salt indexes, K and N-content and efficiency of K and N-fertilizers. Indeed

NSN has a lower salt index per kg of absorbed N[3] than potassium sulphate (SOP) per kg of absorbed K and, taking into account the above mentioned TAP statement, even more so per kg of absorbed N from FYM (farm yard manure) and compost.

page 7, criterion 6: "*Manure compost can contain substantial K, but repeated use of these products can result in a build-up of soil P to environmentally undesirable levels. Furthermore, manure composts can contain high salt concentration, which requires leaching to maintain soil productivity.*"

- TAP-review on Chilean nitrate

page 7, Reviewer 1: "*Much is also made about the high salt index of sodium nitrate, but application of this product at the levels allowed under section 205.602(h) presents little risk in either of these regards. In the eastern U.S. annual rainfall is generally sufficient to maintain salt balance, and in the West the amount of sodium applied in this fertilizer pales in comparison to that contained in most irrigation waters. Also, organic soil building practices generally provide sufficient organic matter to maintain good soil tilth*".

- Following some more quotes and references about sodium in organic amendments and fertilizers:

"*The salt index of liquid manure is very high. This material kills earthworms and hardens the ground*", (NODPA News, July 2002).

"*Composting reduces the amount of raw material by about 2/3, yielding about 35% of the original raw material weight as compost. Sodium concentration in livestock manure can result in compost with sodium concentrations too high for some uses such as potting mixes.*", (Walker Paul, 1999).

"*Most of the studies involving salinity have been conducted on the effect of inorganic fertilizers on plant growth and mineral nutrition. However, the literature on the response of crops to short-term application of composted manure under saline conditions is scanty.*", (Irshad M. et al., 2002).

"*Manure commonly contain 4 to 5% soluble salts (dry weight basis) and may run as high as 10%. To illustrate, an application of 5 tons of manure containing 5% salt would add 500 lbs. of salt.*", (Ecochem, 2004).

ARGUMENT 26: Although some organic fertilizers can also leach nitrates and salts, the impact is reduced by the smaller percentage and lower solubility of sodium and nitrate contained in such products. Risks of sodium and nitrate contamination are more easily managed by the use of Good Management Practices, such as application at appropriate soil temperatures and moisture. Because sodium nitrate is highly soluble and has a high salt index, such management practices are less effective at mitigating such harmful effects.

The sodium (salt) issue is dealt with in the reply on ARGUMENT 25 above.
The nitrate issue is dealt with in the reply on ARGUMENT 24.

[3] and a fortiori per kg of NSN

The above quote: *"Although some organic fertilizers can also leach nitrates and salts"* is further commented as follows: Organic fertilizers are currently the main source of nitrate leaching not only in general terms but also per unit of fertilizer N (total and net N absorbed by the plant).

Also the fact that ① available N and ③ net absorbed N are effectively much lower in organic fertilizer, much higher equivalent quantities (up to 15 times) are needed and therefore even more losses are caused.

The above quote: *"the impact is reduced by the smaller percentage and lower solubility of sodium and nitrate contained in such products"* is commented as follows. It is difficult to understand how the solubility of nitrate and sodium would be lower in organic fertilizers. There seems to be confusion between organic N and mineral N (nitrate) and Na.

Solubility of fertilizer in general and N fertilizer in particular seems to be considered a negative feature in organic agriculture. However the **intended use** of Natural Sodium Nitrate in organic agriculture should be to improve N-efficiency and decrease N losses during some critical growing stages and by the same token improve crop quality and yield. At these particular growing stages this can only be achieved if that N source is plant available and thus present in the soil solution. Therefore solubility is **essential** in this context and will lead to diminished losses.

ARGUMENT 27: The caliche used to produce Chilean nitrate contains perchlorate as a contaminant. Per- chlorate is mobile in the soil as nitrate. Perchlorate was discovered in a number of US water supplies, prompting the US EPA to add it to its Contaminant Candidate List. The ecological impact of perchlorate is not well known. Perchlorate has been discovered in crops, including organically produced lettuce. The contamination of perchlorate in potable water is difficult to treat

First of all the misunderstanding and confusion that is apparent in above comment should be rectified at once: The perchlorate problem in the USA was and is due to industrial pollution and has nothing to with the remaining traces of perchlorate in the product currently shipped to the USA.

Perchlorate is an inorganic anion that is both man-made and naturally occurring. Perchlorate is manufactured to be used, among other uses, as an oxidizing agent and primary component in solid propellant for rockets, missiles, fireworks, and automobile air bag inflators. Years of manufacturing, testing, and improper disposal by these industries have resulted in widespread perchlorate presence in the Colorado River and ground water in California and some others states in the USA. No other documented perchlorate contamination sites have found elsewhere in the world.

Studies of EPA (Environmental Protection Agency, USA), 2002, have refuted the fact that Chilean nitrate could be a contributing factor in perchlorate contaminated surface- and ground water.

ARGUMENT 28: In the relatively few cases where sodium nitrate has been permitted, it has been restricted to use only as a supplement to an organic soil building program, or to a specific crop such as spirulina. Sodium nitrate can enable a farm that is going through transition to avoid a crop failure when the soil biological activity has not been established to provide nitrogen from organic sources. However, such farms have developed a long-term dependence because the addition of sodium nitrate depresses the organisms needed to effectively cycle nitrogen.

It has been sufficiently established that under several critical growing conditions nitrate from organic sources was not sufficient to produce crops of optimal qualitative yield.
See also replies of ARGUMENT 4 and ARGUMENT 7.

ARGUMENT 29: In such situations, some authorities have attempted to limit the amount of nitrogen provided by sodium nitrate. Monitoring a numerical limit on nitrogen contributions has proven to be a recordkeeping burden on the farmer, a verification problem for inspectors, and an administrative burden on the certifier.

All inputs are being already monitored very strictly in organic farming and include record keeping for each of them.

ARGUMENT 30: Experience with growing spirulina under standards where Sodium nitrate is prohibited has demonstrated that Sodium nitrate is not necessary for this particular crop.

One could expect that the spirulina grower community may not agree with this statement and may ask the following question: Why would the spirulina grower community have asked and obtained from the NOP (National Organic Program) an amendment for <u>un</u>restricted use in the USA and from the local authorities in India if there wasn't a serious ground.

ARGUMENT 31: Historical development of the regulatory situation of Chilean Sodium Nitrate in Organic Agriculture.
The use of sodium (Chilean) nitrate from natural deposits has been one of the most contentious and divisive issues throughout the organic agriculture's history. The first IFOAM Basic Standards published in 1980 permitted the restricted use of Chilean Nitrate, reflected by the fact that the fertilizer was still allowed in some countries. IFOAM has published several papers on the subject, recognizing the value of its use, particularly with regard to nitrogen uptake in cold weather at the beginning of the growing season (IFOAM 1984). However even at that time the use of sodium nitrate has been criticized as unnecessary and seen as a controversial practice. In 1984 the use of sodium (Chilean) nitrate was restricted to the use during conversion. Based on an <u>extensive literature review</u> (IFOAM Technical Committee, 1989) and broad discussions with the IFOAM member organizations, the General Assembly in 1989 decided to prohibit sodium (Chilean) nitrate in the IFOAM Basic Standards. The reasons for exclusion correspond with those listed in the table above.

The decision not to allow NSN was based on a literature review (IFOAM Technical Committee, 1989) that was shown to be wide open to discussion and interpretation. (see *"Reply to IFOAM 1989 document" which also can be found on www.naturalnitrogen.com).*

ARGUMENT 32: The Codex Working group considered sodium (Chilean) nitrate in 1997 and 1998 when the criteria for fertilizers were discussed. When the first Codex Alimentarius guideline was published, the Codex Alimentarius Commission decided to not include sodium (Chilean) nitrate in the Annex.

For the same reasons as IFOAM, the European Union, the Japan Organic Standards as well as most of the international certifiers (including major US certifiers) do not allow the use of Chilean Sodium Nitrate in their standards. In the NOP Chilean Nitrate is still allowed, however with restrictions. In a recent review (2002) of sodium (Chilean) nitrate by the USDA National Organic Standards Board Technical Advisory Panel (NOSB TAP), two reviewers were in favor of removing Chilean Nitrate while one favored a phase out to permit farmers to develop viable alternatives. The Organic Trade Association's American Organic Standards, a

voluntary private standard of the organic industry in the United States prohibited the use of sodium nitrate effective January 1, 2003 (OTA, 2003).

The reply on former ARGUMENT 31 is also valid here.

ARGUMENT 33: Because of the salt index and sodium content, sodium nitrate is considered by many agronomists and soil scientists to be an inferior source of nitrogen to ammonium nitrate, calcium nitrate, or potassium nitrate. Unlike these other forms of nitrate, sodium nitrate does not provide any additional fertility benefit besides nitrogen, instead carrying with it sodium, generally recognized to be detrimental in most soils.

Again the TAP-review on synthetic potassium sulphate ,last page,

is referred to: "*Criteria 1-5 are not relevant to this case. But this does not in itself qualify a substance for inclusion. It is not necessary for something to be grossly or subtly toxic or ecologically damaging for it to be inappropriate to organic agriculture. We could name several synthetically derived nitrogen fertilizer sources, for example, which if used in moderation, might not be harmful, and might in fact stimulate biological activity* in *the soil, yet these are <u>clearly and</u> unquestionably disqualified for inclusion on the National List [exactly because they are synthetic]*". This clearly states the paramount importance of the natural (non synthetic) origin of input and the same time indirectly but clearly rebuts some important prejudices against nitrate mentioned in this IFOAM paper.

It is further referred to the replies and comments to all former ARGUMENTS which will as a whole supply the reader with a comprehensive set of reasons and counter-arguments that clearly demonstrate that NSN is probable one of the best examples of an input that supports the systemic (holistic) approach so dear and fundamental to organic farming.

ARGUMENT 34: Sodium nitrate is an anomaly that undermines the case that organic food is better for soil and water quality than other food. Consumers who pay a premium for organic food in part because it has lower free nitrate levels than food grown with synthetic fertilizers are cheated when "organic" vegetables grown in the cold season with sodium (Chilean) nitrate are no different ceteris paribus from those grown with a conventional fertilizer like ammonium nitrate, calcium nitrate, or potassium nitrate. While sodium nitrate lowers production costs in certain situations, the principles of organic farming are undermined by its use.

All former ARGUMENTS are referred to and the following is added:
Complementary use of NSN will allow the organic farmer to optimize production. This and the access to a more economic source of N will give the organic farmer a competitive advantage in the market place and will contribute in maintaining rural communities.

It was clearly shown that the judicious use of Natural Sodium Nitrate respects and supports the cyclical precautionary and nearness principles dear to the organic agriculture community. It supports expressions of value and ethics such as: "self-reliance", "biologically robust", "high general standard of nutrition", "enlightened agriculture", "ecology, sensible balance", "excellence in husbandry", "productivity together with sustainability", "maintaining rural communities", "shorter supply chain", etc.

Natural Sodium Nitrate, as an essential but most natural plant food, has proven to be a valuable contribution to the success of organic agriculture in that it will allow organic agriculture to improve in a significant way its productivity, sustainability, its potential to produce fresh food of best quality and to fulfill the logistical requirements to offer a fair deal for consumers and promote local labor intensiveness by shortening the supply chain and promoting national self reliance.

Its judicious use is part of common sense agriculture and reflects biological reality.

Natural Sodium Nitrate is not an "anomaly" but a gift from nature.

Before the introduction of synthetic nitrogen, when the entire world agriculture was basically organic, farmers already used this nitrogenous rock to maintain soil fertility. Natural Sodium Nitrate was used as organic fertilizer before organic agriculture became a world movement.

For more background information, references and bibliography we refer to the book "*Natural Nitrogen, Nitrogenous rock*" (to obtain this document send an e-mail to info@naturalnitrogen.com or download from the web site www.naturalnitrogen.com) and the document "*The Use of Natural Sodium Nitrate Compared to Authorized Animal Waste Products*" which also can be obtained by sending an e-mail to info@naturalnitrogen.com.

2 ADDENDUM IFOAM EVALUATION OF NSN "IFOAM 2004"

IFOAM Evaluation of some controversial substances against the criteria in the Codex Guidelines for organically produced food (ALINORM 03/22A)

IFOAM applied the following scoring:

SCORING	++ very positive	+ positive	0 not to evaluate	~both positive and negative	- negative	-- very negative

A. Substances, which should not be included in Table 1 for fertilization and soil conditioning purposes:
IFOAM Evaluation of CHILEAN SODIUM NITRATE (proposed by Chile)

Criteria for the non-inclusion or amendment of a substance in Annex 2, Table 1.

Section 5.1 *General Principles* Consistent with the principles of organic production	ARGUMENT 1 The principles state that the 'fertility and biological activity of the soil should be maintained or increased, where appropriate, by cultivation of legumes, green manures or deep-rooting plants in an appropriate multi-annual rotation program; incorporation in the soil of organic material . 'ARGUMENT 2 Specific substances may be applied 'only to the extent that adequate nutrition of the crop or soil conditioning are not possible by [these] methods.' (Codex Alimentarius GL 32-1999, rev 2001, Chapter Annex I Principles of organic production point 5). ARGUMENT 3 Sodium (Chilean) nitrate application is directly counter to these principles because it contains no organic matter, and because it is possible to obtain adequate nutrition of crops from organic material without the application of sodium nitrate. ARGUMENT 4 Organic material that contains nitrogen enhances soil fertility for a longer period of time, and stimulates biological activity more than sodium nitrate. ARGUMENT 5 While certain specific mineral fertilizers may be used to supply nutrients that are otherwise depleted, soil microorganisms dissolve these nutrients first. In organic agriculture one of the basic principles is to fertilize/nourish primary the soil and not directly the plant. In contrast, sodium nitrate is immediately soluble without being digested by soil organisms. ARGUMENT 6 Some papers indicate that sodium nitrate has no effect, either beneficial or adverse, on soil organism populations. However, studies show that soluble nitrogen fertilizers simplify soil ecology and reduce biodiversity of soil organisms. ARGUMENT 7 In particular research has shown that applications of soluble nitrogen fertilizers in general and sodium nitrate in particular depress the activity of nitrogen fixing organisms. ARGUMENT 8 The allowed mineral fertilizers are different rocks, natural rock phosphate, calcium and magnesium carbonate, gypsum and others. The nutrients are generally not in an easy soluble form. In case of Chilean nitrate the substance is a water-soluble extract of *caliches; the rock used,* and is not comparable with the hardly soluble rock phosphates and the other mineral fertilizers (see below).	--
Substance is necessary / essential for its intended use	ARGUMENT 9 In organic farming systems, nitrogen is obtained from crop rotations that include nitrogen-fixing leguminous crops, free-living nitrogen fixing organisms, and the application of compost and manure. ARGUMENT 10 Plant and animal by-products can be used to provide supplemental nitrogen. ARGUMENT 11 Organic agriculture relies on "slow release" fertilizers by using less soluble mineral fertilizers, but also with the use of organic nitrogen fertilizers. Therefore, given the abundance and ready availability of such sources, Sodium nitrate is unnecessary and cannot be considered essential for its intended use.	--
Manufacture, use and disposal does not result in, or contribute to, harmful effects on the environment	ARGUMENT 12 Most sodium nitrate fertilizer is mined in Chile. The environmental impact is similar to that of other mined minerals. ARGUMENT 13 Given the geographically limited reserves and isolated supply, the transportation of nitrogen long distances has a potential to cause greater adverse environmental impacts than most other mined minerals. In most areas in the world there are local resources available for the production of organic commercial fertilizers, however these might be more expensive or more complicated than manufacturing sodium nitrate.	-
lowest negative impact on human or animal health and quality of life	ARGUMENT 14 Research has shown that crops fertilized by sodium nitrate will have significantly higher levels of free nitrate than crops fertilized with compost or manure. This effect is most pronounced in winter when fertilizing with pure soluble sodium nitrate is the only nitrogenous soil amendment. Sodium nitrate potentially increases the nitrate content in leafy vegetables such as salads. Although this risk must also be taken into consideration when using organic fertilizers, the unique use of Sodium (Chilean) nitrate in spring, which would be likely the case in practice, raises this risk. ARGUMENT 15 Nitrate will be reduced in the human body to nitrite, which has been linked to methemoglobinemia, a potentially fatal condition whereby nitrites interfere with oxygen uptake. Pregnant women and small children are at a particularly high risk from methemoglobinemia. Nitrites can also be further reduced to nitrosamines which compounds are strong carcinogens.	-

approved alternatives not available	ARGUMENT 16 Organic growers throughout the world have successfully developed systems that use compost, green manure, and plant and animal by-products to supply the nitrogen needed to grow all commercial crops throughout the year over a wide range of climates and soils.	--
Section 5.1(a) Used for fertilization and soil conditioning Essential for obtaining or maintaining fertility of the soil or fulfil specific nutrition requirement of crops, soil conditioning and rotation purposes witch cannot be satisfied by the practices included Annex 1, or other products included in Table 2 of Annex 2.	ARGUMENT 17 An organic fertilizing system is based on cultivation of legumes in a crop cycle with cash crops and green manure in combination with farmyard manure and compost where available. Such a system contains a balance of nitrogen and carbon sources, both of which nourish soil organisms that are essential for the cycling of nutrients. Carbon stabilizes the soil biomass and provides energy to soil organisms. Nitrogen is stored in the form of proteins that are slowly released by the biological decomposition of organic matter. By contrast, sodium (Chilean) nitrate contains no carbon and supplies soluble nitrates in a simple form similar to synthetic fertilizers such as potassium nitrate or calcium nitrate. A nitrate fertilizer that lacks carbon creates a carbon: nitrogen imbalance that increases the metabolic rate of soil microbial biomass that in turn accelerates the mineralization of soil organic matter. The crop response and increase in soil fertility is short-lived. ARGUMENT 18 With organic commercial fertilizers it is also possible to get a higher mineralization in cold soils for vegetable growing in the early season. These commercial fertilizers are for example based on horn or feather meal, malt sprouts, fishmeal, or bean meal among others. With these fertilizers it is possible to grow even heavy feeding crops such as cauliflower with products found on annex 2 in the early spring. Although such fertilizers are usually more expensive per unit of nitrogen and often more difficult to handle, they are nonetheless available alternatives that better maintain the long-run fertility and condition of the soil and are more suitable for crop rotations than sodium (Chilean) nitrate. ARGUMENT 19 More research is clearly needed to improve the efficiency of organic sources of nitrogen, but this does not support the case that sodium nitrate is essential.	--
Ingredient is of plant, animal, microbial or mineral origin; may undergo the following processes: Physical (Mechanical, thermal), enzymatic or microbial (composting, fermentation); only when the above processes have been exhausted, chemical processes may be considered and only for the extraction of carriers and binders.	ARGUMENT 20 The Chilean source fulfils the criterion of being a source of mineral origin without further chemical processing. However, sodium nitrate may also be synthesized by a number of processes (Collings, 1950). ARGUMENT 21 Most of the sodium nitrate mined in the Atacama desert is processed into potassium nitrate, with iodine a significant co-product (USGS). A certain amount of chemical processing may take place to separate the iodine and remove toxic impurities such as perchlorates. At present, most of the beneficiation involves raising the potassium level and does not appear to be used to maintain the fertilizer guarantee levels in the sodium nitrate. However, products identified as 'nitrate of soda-potash', 'Chile saltpeter', or 'niter' would not meet this criterion and should not be considered 'Chilean nitrate' even though they originate from Chile and contain nitrate. ARGUMENT 22 Although only small amounts of sodium nitrate are known to exist at present, it is conceivable that another commercial deposit could be opened somewhere else in the world. "Chilean nitrate" implies that one nation should be given license to control an international monopoly over the production of a given input. For the purpose of clarity, the dossier should refer to 'natural sodium nitrate' and not 'Chilean nitrate'.	+

Their use does not have a harmful impact on the balance of the soil ecosystem or on the soil physical characteristics, or water and air quality	ARGUMENT 23 Sodium nitrate accelerates the mineralization and depletion of soil organic matter, in contrast to organic nitrogen fertilizers that maintain and improve soil organic matter. ARGUMENT 24 Nitrate is highly mobile in soil. Nitrate that is not immediately assimilated by plants can be leached in the ground water. ARGUMENT 25 The salt index of Chilean nitrate is 100, which is higher than almost every other fertilizer (Rader et al., 1943). For most crops and in many areas, the addition of sodium which can pose a problem in some areas. In irrigated regions or in greenhouses it is necessary to leach the sodium periodically "out of the system" to prevent the salinity of the soil. A higher consumption of water and a load of salt to the environment is the negative impact/consequence. ARGUMENT 26 Although some organic fertilizers can also leach nitrates and salts, the impact is reduced by the smaller percentage and lower solubility of sodium and nitrate contained in such products. Risks of sodium and nitrate contamination are more easily managed by the use of Good Management Practices, such as application at appropriate soil temperatures and moisture. Because sodium nitrate is highly soluble and has a high salt index, such management practices are less effective at mitigating such harmful effects. ARGUMENT 27 The caliche used to produce Chilean nitrate contains perchlorate as a contaminant. Per- chlorate is mobile in the soil as nitrate. Perchlorate was discovered in a number of US water supplies, prompting the US EPA to add it to its Contaminant Candidate List. The ecological impact of perchlorate is not well known. Perchlorate has been discovered in crops, including organically produced lettuce. The contamination of perchlorate in potable water is difficult to treat.	-
Use may be restricted to specific conditions, specific regions or specific commodities	ARGUMENT 28 In the relatively few cases where sodium nitrate has been permitted, it has been restricted to use only as a supplement to an organic soil building program, or to a specific crop such as spirulina. Sodium nitrate can enable a farm that is going through transition to avoid a crop failure when the soil biological activity has not been established to provide nitrogen from organic sources. However, such farms have developed a long-term dependence because the addition of sodium nitrate depresses the organisms needed to effectively cycle nitrogen. ARGUMENT 29 In such situations, some authorities have attempted to limit the amount of nitrogen provided by sodium nitrate. Monitoring a numerical limit on nitrogen contributions has proven to be a recordkeeping burden on the farmer, a verification problem for inspectors, and an administrative burden on the certifier. ARGUMENT 30 Experience with growing spirulina under standards where Sodium nitrate is prohibited has demonstrated that Sodium nitrate is not necessary for this particular crop.	0

Historical development of the regulatory situation of Chilean Sodium Nitrate in Organic Agriculture

ARGUMENT 31 The use of sodium (Chilean) nitrate from natural deposits has been one of the most contentious and divisive issues throughout the organic agriculture's history. The first IFOAM Basic Standards published in 1980 permitted the restricted use of Chilean Nitrate, reflected by the fact that the fertilizer was still allowed in some countries. IFOAM has published several papers on the subject, recognizing the value of its use, particularly with regard to nitrogen uptake in cold weather at the beginning of the growing season (IFOAM 1984). However even at that time the use of sodium nitrate has been criticized as unnecessary and seen as a controversial practice. In 1984 the use of sodium (Chilean) nitrate was restricted to the use during conversion. Based on an extensive literature review (IFOAM Technical Committee, 1989) and broad discussions with the IFOAM member organizations, the General Assembly in 1989 decided to prohibit sodium (Chilean) nitrate in the IFOAM Basic Standards. The reasons for exclusion correspond with those listed in the table above.

ARGUMENT 32 The Codex Working group considered sodium (Chilean) nitrate in 1997 and 1998 when the criteria for fertilizers were discussed. When the first Codex Alimentarius guideline was published, the Codex Alimentarius Commission decided to not include sodium (Chilean) nitrate in the Annex.

For the same reasons as IFOAM, the European Union, the Japan Organic Standards as well as most of the international certifiers (including major US certifiers) do not allow the use of Chilean Sodium Nitrate in their standards. In the NOP Chilean Nitrate is still allowed, however with restrictions. In a recent review (2002) of sodium (Chilean) nitrate by the USDA National Organic Standards Board Technical Advisory Panel (NOSB TAP), two reviewers were in favor of removing Chilean Nitrate while one favored a phase out to permit farmers to develop viable alternatives. The Organic Trade Association's American Organic Standards, a voluntary private standard of the organic industry in the United States prohibited the use of sodium nitrate effective January 1, 2003 (OTA, 2003).

ARGUMENT 33 Because of the salt index and sodium content, sodium nitrate is considered by many agronomists and soil scientists to be an inferior source of nitrogen to ammonium nitrate, calcium nitrate, or potassium nitrate. Unlike these other forms of nitrate, sodium nitrate does not provide any additional fertility benefit besides nitrogen, instead carrying with it sodium, generally recognized to be detrimental in most soils. ARGUMENT 34 Sodium nitrate is an anomaly that undermines the case that organic food is better for soil and water quality than other food. Consumers who pay a premium for organic food in part because it has lower free nitrate levels than food grown with synthetic fertilizers are cheated when "organic" vegetables grown in the cold season with sodium (Chilean) nitrate are no different *ceteris paribus* from those grown with a conventional fertilizer like ammonium nitrate, calcium nitrate, or potassium nitrate. While sodium nitrate lowers production costs in certain situations, the principles of organic farming are undermined by its use.

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