

**PETITION TO REMOVE THE PROHIBITION FOR  
USE OF CALICUM CHLORIDE AS A SOIL  
APPLIED NON SYNTHETIC SUBSTANCE IN  
ORGANIC CROP PRODUCTION**

**Petition submitted on behalf of:**

**TETRA Technologies, Inc.  
24955 Interstate 45 North  
The Woodlands, TX 77380**

**Date: October 12, 2015**

**Submitted by:**

**Dr. Suren Mishra  
Manager, Business Development  
TETRA Technologies, Inc.  
Phone: 281.364.4301**

**Petition Response Item A**

Non-synthetic substances for use in  
Organic Crop Production.

## Petition Responses Item B

1.	Common Name	Calcium Chloride
2.	Manufacturer	TETRA Technologies, Inc. 24955 Interstate 45 North The Woodlands, TX 77380 Ph: 281-367 1983
3.	Current Use	Fertilizer, soil and foliar applications.
4.	Crop Use	Soil application to all crops. Primary use on row crops and tree & vine crops. May be used via drip irrigation, water run, soil applied or as a foliar application. Used as a source of free calcium and to supply plant requirements for chloride, and for remediation of salt affected soils, and for the stabilization of leachable phosphorus and nitrogen in soil.
5.	Source of Substance	As part of mining reclamation program, TETRA is using a brine process to extract CaCl <sub>2</sub> from the Cadiz Dry Lake project near Amboy, CA. A detailed description of the brine extraction process is included in Appendix A.
6.	Previous Review	CaCl <sub>2</sub> (from natural brine process) was listed on the approved NOP list for crop production as a foliar application in Federal Register notice 10.31.03. Petition to allow use as a soil application was denied on 11.25.06 (App. B). KCl was reviewed as a soil application and is allowed for soil use (App. F, Sect. 205.602).
7.	Registrations	CaCl <sub>2</sub> is registered as a fertilizer, category agricultural mineral, in those states requiring registration ( a list included in Appendix C).

8.	CAS No. and Labels	CAS No. 10043-52-4 inorganic salt. Hi-Cal liquid calcium fertilizer label included in Appendix D. (Note: also refer to Appendix E for chemical properties).
9.	Physical Properties	Properties of CaCl <sub>2</sub> are included in the Product Data Sheet (PDS) for Hi-Cal (Appendix E). Appendix F describes chemical interactions and effects on soil organisms and crops. Calcium chloride is used in a multitude of commercial applications including treatment of human calcium deficiencies, to melt snow and ice on roads/highways and pavements, and as a food treatment etc. It has low toxicity and is persistent as free calcium and chloride until used by the plant or leached from the soil profile. Minimal adverse effects on the environment are expected from the use of CaCl <sub>2</sub> as a soil application.
10.	Safety Information	A Safety Data Sheet (SDS) is included with this submission (Appendix E). Also included in Appendix E are responses from the National Institute of Environmental Health Studies. No adverse data for CaCl <sub>2</sub> were found in these queries.
11.	Research	We are unable to locate any research publications stating that the use of CaCl <sub>2</sub> in a managed fertility program will cause detrimental effects of Cl on the plant growth. KCl, as a soil amendement is allowed by NOP. Yes, the use of KCl has greater propensity to accumulate chloride than CaCl <sub>2</sub> (See also Appendix F, "OMRI comment to NOP Proposed Ammendments, 04.28.03). Further explanation is given in an article "Calcium Chloride and Potassium Chloride in Soil Application: A Comparative Analysis" given in Appendix G.

12.	Petition Justification	Appendix G provides an in-depth comparison of calcium chloride versus potassium chloride (Suren Mishra, Ph.D. TETRA Technologies, Inc.) and a very informative report from Tom Ruehr, Ph.D. Cal Poly State University, Earth and Soil Science Department, supporting the petition to remove calcium chloride from the Prohibited Status list and allow its use as a soil amendment, is reincluded in this petition.
13.	Commercial Confidential Information Statement	No data submitted with this petition is considered confidential business information.

## Table of Contents

### **Appendix A**

- Mining Method: Reclamation Plan
- Process Description
- Process Flowsheet

### **Appendix B**

- NOSB Committee Recommendation (09/06/2006)

### **Appendix C**

- States Calcium Chloride is Registered as a Fertilizer Under the Category of Agricultural Mineral

### **Appendix D**

- Product Data Sheet: Hi-Cal Liquid Calcium
- Label: Hi-Cal Liquid Calcium

### **Appendix E**

- Safety Data Sheet: Hi-Cal Liquid Calcium Chloride
- Envirofacts Master Chemical Integrator (EMCI): Calcium Chloride Dihydrate (CAS# 10035-04-8) – updated May 23, 2002

### **Appendix F**

- Proposed Rules: Federal Register, Vol. 68, No. 73, Wednesday, April 16, 2003
- Organic Material Review Institute: Comments on USDA, National Organic Program: Proposed Amendments to the National List of Allowed and Prohibited Substances (7CFR Part 205, Docket No. TMD-02-03)

### **Appendix G**

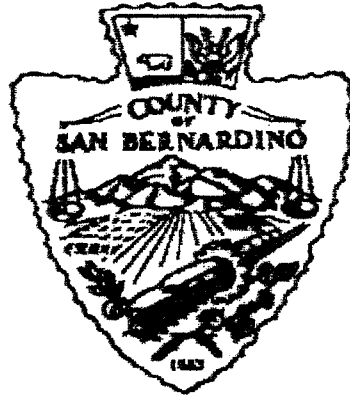
- Mishra: Calcium Chloride and Potassium Chloride in Soil Application: A Comparative Analysis
- Mishra: Salt Affected Soil: Problems and Solutions
- Ruehr: Informative Report to National Organic Standard Board (August 10, 2004)
- References Related to Calcium and Chloride as Plant Nutrients

## **Appendix A**

- Mining Method: Reclamation Plan
- Process Description
- Process Flowsheet

APPENDIX A

Hearing Date May 31, 1990  
 Agenda Item 4  
 Approval Date June 12, 1990  
 Revision August 16, 1993



745/DSS/ 88/004185/SAMR/01  
 SAMR/ 88-0050/DS 1033-17

REVISED RECLAMATION PLAN  
 (90M-03)

TETRA TECHNOLOGIES  
 CADIZ DRY LAKE

TETRA CHEMICALS  
 P.O. BOX 73087  
 HOUSTON, TX 77273

THIS RECLAMATION PLAN  
 EXPIRES ON  
 DECEMBER 31, 2020

**APPROVED**





# RECLAMATION PLAN



Project Title Cadiz Dry Lake

Reclamation Plan Number: 90M-03      Expiration Date: 12/31/2020

Name of Project Proponent: Tetra Chemicals

Address of Project Proponent: P.O. Box 73087  
Houston, TX 77273

Project Location: Cadiz Dry Lake, 18 miles south of Cadiz; 12 miles north of SH 62.  
(T 2N, R15E, Sections 2,3,10, 11,13 )

Type of Operation: Solar Evaporation on a dry lakebed

Mineral Commodity: Liquid Calcium Chloride

Quantity of Ore 21,000 tpy

Operation Time Frame: 30 years      Reclamation Time Frame: 2 years

Area to be mined and reclaimed: 685 acres

Total holdings: 6,720 acres

Maximum Anticipated Depth: Water extraction at 270 +/- feet ; Ponds at < 10 feet

Reclaimed to: A condition mitigating physical hazards to the public. Trenches and ponds will be backfilled and all buildings and equipment will be removed. Vacant Open Space.

Effect on Future Mining: Reclamation will not preclude future mining of the deposit.

State Agency: Department of Conservation  
 Office of Mine Reclamation  
 Reclamation Unit  
 801 K Street, M.S. 09-06  
 Sacramento, CA 95814  
 (916) 323-9198

Lead Agency: San Bernardino County  
 Land Use Serv. Department  
 Environmental Team  
 385 N. Arrowhead Avenue  
 San Bernardino, CA 92415  
 (909) 387-4147

Lead Agency Contact Person:

Richard L. Touslee

Date: April 3, 2002

Richard L Touslee, Senior Associate Planner

NOTE: This and supplemental documents for the non-proprietary portions of the project are on file and available for review at the state and lead agency addresses above.

# LAND USE SERVICES DEPARTMENT



COUNTY OF SAN BERNARDINO  
ECONOMIC DEVELOPMENT  
AND PUBLIC SERVICES GROUP

**PLANNING DIVISION**

185 North Arrowhead Avenue • San Bernardino, CA 92415-0182 • (909) 387-4131  
First Floor Fax (909) 387-3249 • Third Floor Fax (909) 387-3223  
15505 Civic Drive • Victorville, CA 92392 • (760) 243-8245 • Fax (760) 243-8212  
<http://www.sbcounty.gov/landuseservices>

MICHAEL E. HAYS  
Director of Land Use Services

April 3, 2002

Tetra Chemicals  
P.O. Box 73087  
Houston TX 77273

RE: Transfer of Ownership for the Cadiz Dry Lake Project,  
CA Mine ID # 91-36-0043  
APN 0644-151-21

Dear Sirs:

Your application for a transfer of ownership for the Cadiz Dry Lake Project, currently permitted to Lee Chemical, has been received, reviewed by staff and is approved effective this date.

A. Condition of Approval # 11 (added)

In the event that Tetra Chemicals leases the project to another operator, a copy of that lease shall be provided to the Lead Agency.

The expiration date for Reclamation Plan 90M-03 remains December 31, 2020. Mining is to cease prior to that date, so that all requirements of the Reclamation Plan are complete as of December 31, 2020.

The bond instrument you have provided has been reviewed and approved by the Lead Agency and will be forwarded to the Office of Mine Reclamation for their concurrence. Upon final acceptance of the Tetra Chemicals bond, the Lee Chemical CDs will be released. Notification will be by separate correspondence.

Additionally, responsibility for filing and payment of appropriate fees for the CY 2002 Mining Operation Annual Report remain the responsibility of Lee Chemical, as transfer of ownership has occurred after 12/31/01. Tetra Chemicals is now responsible for ongoing compliance with SMARA and the County Code for the annual mine inspection program. Correspondence pertinent to that program will be forwarded under separate cover.

JOHN F. MICHAELSON  
County Administrative Officer  
JOHN GOSS  
Assistant County Administrator  
Economic Development and

Board of Supervisors			
BILL POSTMUS .....	First District	DENNIS HANSBERGER .....	Third District
JON D. MIKELS .....	Second District	FRED AGUIAR .....	Fourth District
JERRY EAVES .....	Fifth District		

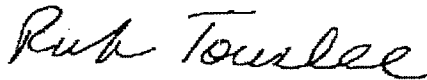
Tetra Chemicals  
April 3, 2002

An amended plan 90M-03 will be published and forwarded under separate cover in approximately 30-45 days.

Pursuant to Title 8, Sections 82.010410 and 83.010605 of the San Bernardino County Code, any interested person may, within ten (10) days after the date of this notice, appeal in writing to the Planning Commission for consideration thereof. The appeal must be made in writing on forms available from the Public Information Counter.

Should you have any questions, please contact me at (760) 243-8175.

Sincerely:

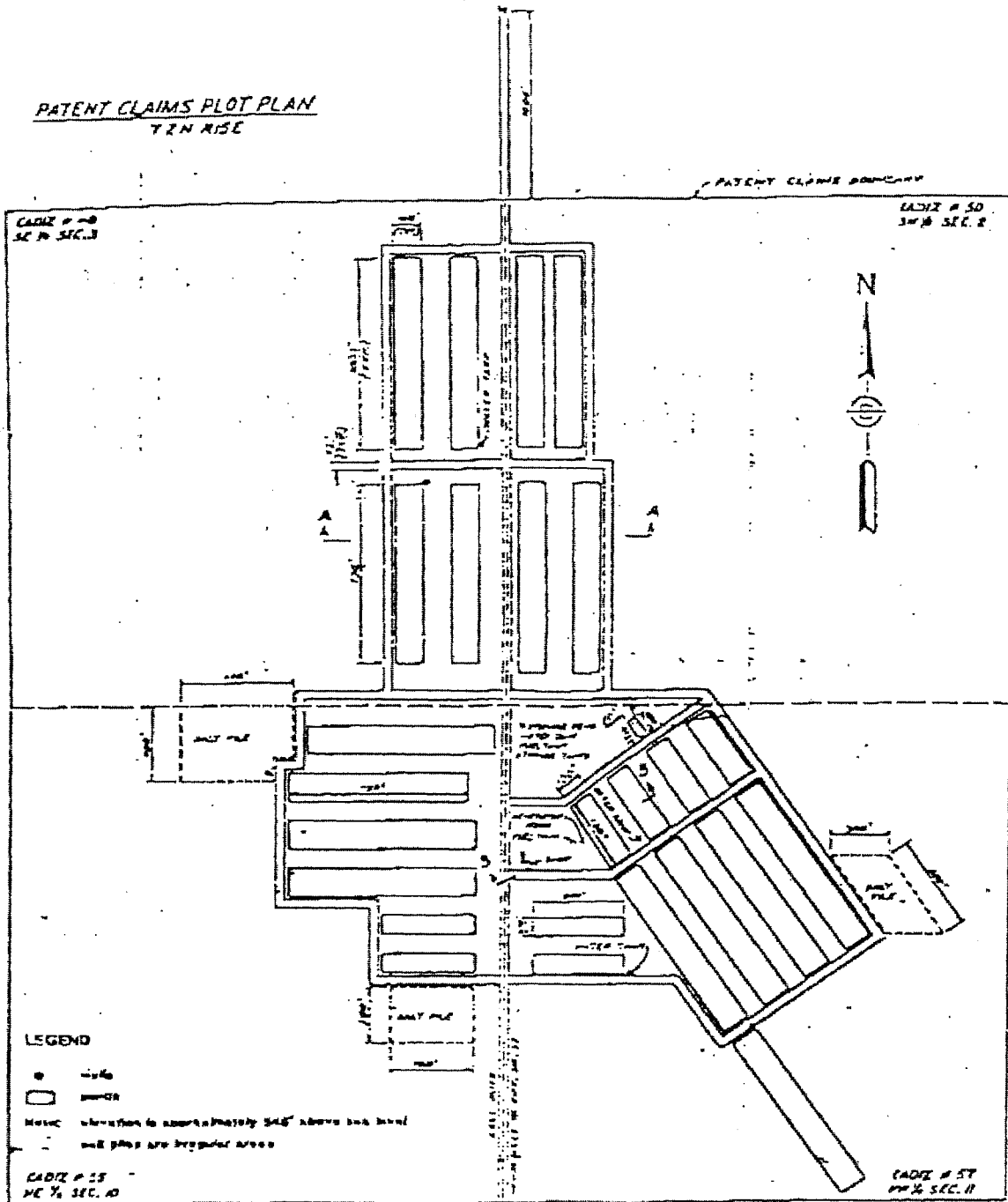


Rich Touslee, Senior Associate Planner  
Advance Planning

Cc: Randy Scott, Division Chief  
Lee Chemical  
Department of Conservation/ Office of Mine Reclamation  
File

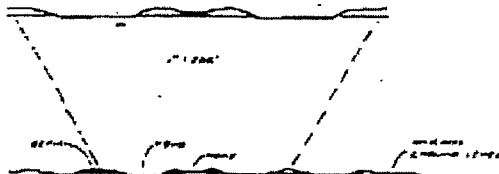
# MINING/RECLAMATION PLOT PLAN

PATENT CLAIMS PLOT PLAN  
T 2 N RISE



**LEGEND**

- well
- structure
- Note: elevation is approximately 340' above sea level
- well pits are irregular areas



SECTION A-A

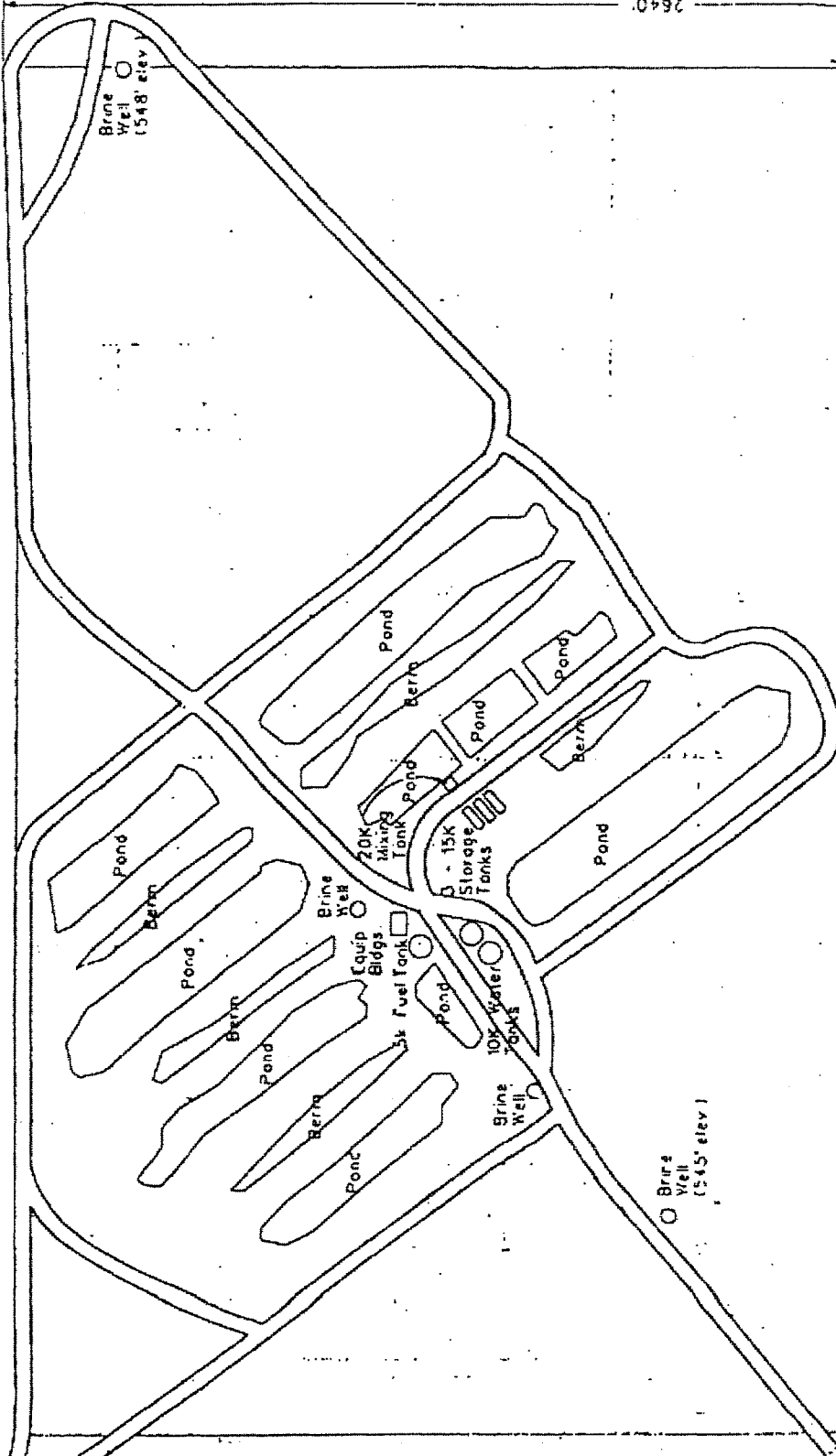
SECTION A-A  
AFTER RECLAMATION



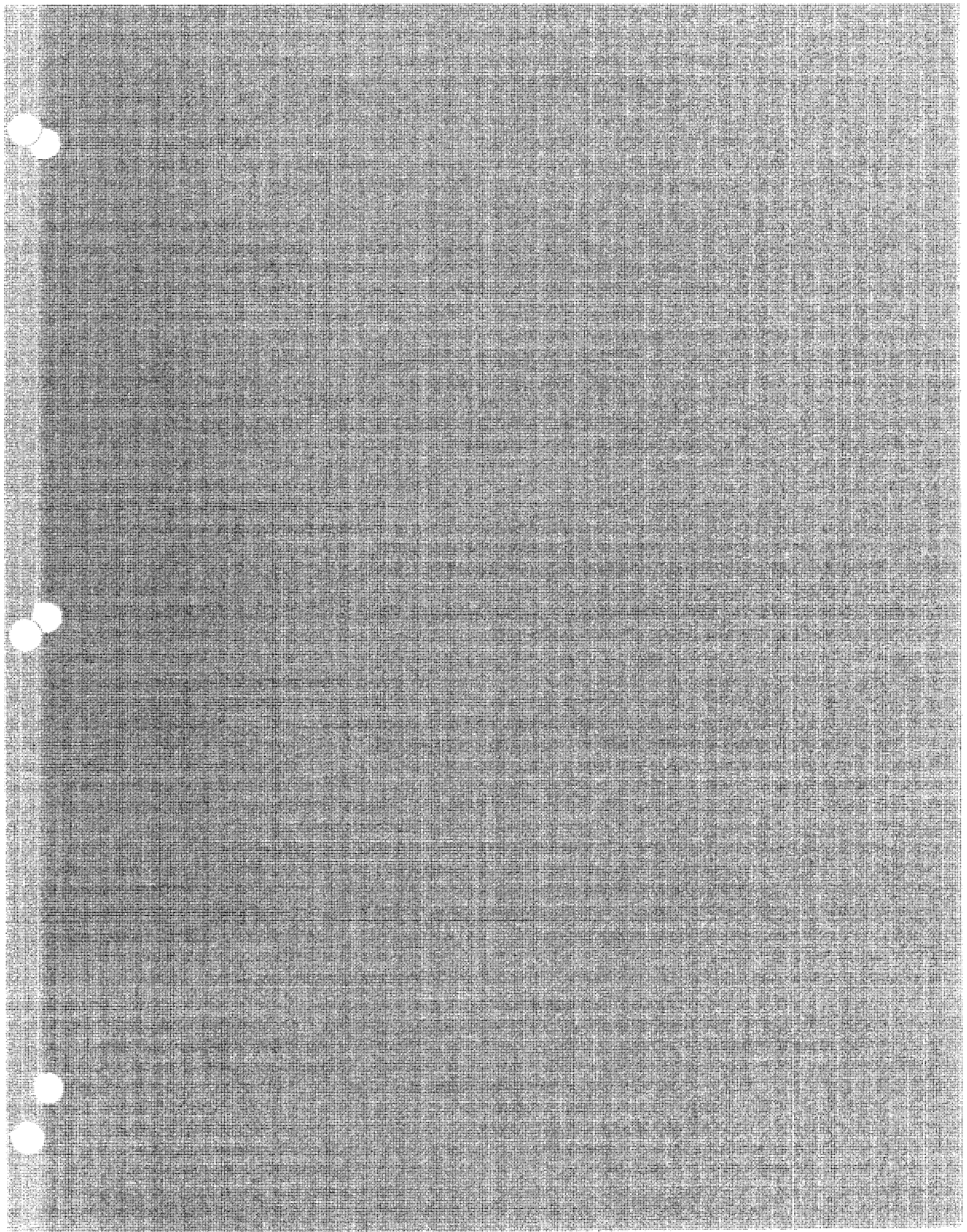
SECTION B-B

1993 ADDITIONAL LANDS PLOT PLAN

2640



EVAPORATORS



Hearing Date May 10, 2001

Agenda Item 2

Approval Date May 21, 2001



745/DSS/00010737/SMA/01  
SMA/DS 881-169/00

MINING/RECLAMATION PLAN  
(2001M-03)

TETRA TECHNOLOGIES  
AMBOY PLANT

TETRA TECHNOLOGIES, INC  
P.O. BOX 38  
AMBOY, CA 92304

THIS MINING/RECLAMATION PLAN  
EXPIRES ON  
MAY 21, 2031

**APPROVED**



# MINING CONDITIONAL USE PERMIT AND RECLAMATION PLAN



Project Title Amboy Plant

Reclamation Plan Number: 2001M-03 Expiration Date: 5/21/2031

Name of Project Proponent: Tetra Technologies, Inc

Address of Project Proponent: P.O. Box 38  
Amboy, CA 92304

Project Location: 2 mile east of Amboy, 1 mile south of National Trails Hwy on Saltus Rd.  
(T 5/6N, R12/13E, Sections - Multiple)

Type of Operation: Saline Recovery and concentration

Mineral Commodity: Calcium Chloride and sodium chloride

Quantity of Ore 40,000 tpy

Operation Time Frame: 30 years Reclamation Time Frame: 2 years

Area to be mined and reclaimed: 4,792 acres

Total holdings: 10,835 acres

Maximum Anticipated Depth: Water extraction at 270 +/- feet ; Ponds at < 10 feet

Reclaimed to: A condition mitigating physical hazards to the public. Trenches and ponds will be backfilled and all buildings and equipment will be removed. Vacant Open Space.

Effect on Future Mining: Reclamation will not preclude future mining of the deposit.

State Agency: Department of Conservation  
Office of Mine Reclamation  
Reclamation Unit  
801 K Street, M.S. 09-06  
Sacramento, CA 95814  
(916) 323-9198

Lead Agency: San Bernardino County  
Land Use Serv. Department  
Environmental Team  
385 N. Arrowhead Avenue  
San Bernardino, CA 92415  
(909) 387-4147

Lead Agency Contact Person:

Richard L. Touslee  
Richard L. Touslee, Senior Associate Planner

Date: May 21, 2001

NOTE: This and supplemental documents for the non-proprietary portions of the project are on file and available for review at the state and lead agency addresses above.



## I MINING

### 1.1 Mining Operation Introduction

TETRA Technologies, Inc.'s operation at Amboy, California recovers brines that are concentrated through the use of solar evaporation to produce granular solar salt and liquid calcium chloride. Figures 1 and 2 show the general location of the project. Figure 3 shows the extent of the TETRA Technologies, Inc.'s holdings.

The brines are recovered from two sources. One source is a series of wells that provide a solution containing both calcium chloride and sodium chloride. These wells are along the northeastern boundary of the property along the playa edge. The other source is a collection of pits and trenches that provide calcium chloride solution. The pits are located in the southeastern portion of the property. The trenches are located in the evaporating complex in the southwestern portion of the property.

TETRA Technologies, Inc. plans to expand the operation by refurbishing existing, or constructing more wells, pits and trenches within the permit boundary (Figure 4).

#### 1.1.1 Description of Proposed Mining Operation

### 1.2 Sodium Chloride Production

The brine wells produce a weak solution of calcium and sodium chloride that is concentrated by solar evaporation. During the calcium chloride recovery process, sodium chloride is recovered as the sodium chloride salt precipitates out. The sodium chloride is precipitated in several crystallizer basins and then recovered utilizing an elevating scraper.

Along with the sodium chloride, small amounts of calcium-sulfate precipitate contaminates the sodium chloride. This problem is addressed by washing the salt crystals in a countercurrent sand screw washer. The finer sulfate precipitates are readily removed from the coarse salt crystals. The salt crystals are discharged to a stockpile and the calcium sulfate is discharged to a salt-wash-water holding basin where the sulfate is allowed to settle out. This process takes place in the evaporating complex.

The salt wash water basin is routinely recharged with weaker brine solutions as the stronger solutions are advanced to the salt crystallizers. The calcium sulfate solids are periodically removed, once every several years, and placed on existing burden pile areas to dry. Liquid from these solids and runoff is allowed to drain back into the evaporation trenches.

The washed sodium chloride crystals are shipped from the evaporating complex by bulk truck.

### 1.1.1.2 Calcium Chloride Production

Brines from pits and trenches are gathered and combined with the partially concentrated brine discharged from the salt crystallizers. Two products are made from the brine: untreated calcium chloride solution and treated calcium chloride solution.

The untreated solution is simply allowed to continue concentrating through the solar evaporation process until it reaches a marketable concentration. The untreated material is segregated in storage ponds, located in the evaporating complex. From the storage ponds, it is sold in bulk truck and bulk rail quantities.

The treated calcium chloride solution has magnesium removed from it by contacting partially concentrated brine with a quick-lime solution ( $\text{CaO} + \text{H}_2\text{O}$ ). This temporarily elevates the pH of the brine causing magnesium hydroxide ( $\text{MgOH}_2$ ) to precipitate. The reaction is rapid, and the brine quickly normalizes from an initially high pH value of about 9. The precipitated solids are allowed to settle out as the brine continues to concentrate in designated settling basins.

The precipitated solids are allowed to collect in the settling basins. Periodically, every several years, the settled solids are removed and placed on overburden piles adjacent to the settling basins. The liquid that drains from the solids and any subsequent precipitation is allowed to run back into the settling basins.

Once the treated brine reaches market grade strength, the clear brine is decanted from the settling basin and placed in storage ponds located in the evaporating complex. The treated calcium chloride is shipped from the site by bulk truck and rail.

### 1.1.2 History of Area

The Bristol Dry Lake playa and surroundings have been used for the mining of gypsum, sodium chloride and calcium chloride since 1908. The initial operations were for the recovery of gypsum at the edge of the playa. Gypsum was recovered until the mid-1920's. While the location of the gypsum operation is generally known, the area has eroded and has largely returned to the natural state of a flat playa margin.

Rock salt was recovered using open-pit mining methods until the mid-1970's. The original claim holders operated the site until 1921 when the claims were taken over by the California Rock Salt Company. In 1923, ownership shifted to the California Salt Company. In 1938, Leslie Salt purchased half of the California Salt Company and in 1958 bought out the remaining half. In 1992, Cargill, Incorporated purchased Leslie Salt. Cargill operated the site until August of 1998 when the current owner, TETRA Technologies, Inc. purchased it.

Over the years, the United States Geological Survey (USGS), the Metropolitan Water District (MWD), Southern California Edison Utility Company, and the various owners did exploratory work

in the playa area. In 1952, core drilling to a depth of 1005 feet was performed. Core was recovered to a depth of 950 feet that indicated continuous alternating salt and sediment beds to at least that depth. Extensive exploration work to a depth of around 100 feet was performed in the early 1960's. The work indicated extensive salt beds under much of the claim area. In 1985, deep core drilling to a depth of approximately 1750 feet was performed. Core recovered to a depth of approximately 1700 feet also indicated continuous alternating salt and sediment beds (Rosen, 1989, pgs. 92-116).

### 1.1.3 Extraction Method and Equipment Description

Brine is extracted from the wells with submersible down-hole pumps. The down-hole pumps discharge the brine into surface piping that carries the brine to a polypropylene collection tank. Brine is pumped from the collection tank through six-inch high-density polyethylene pipeline to the first collection ditch. The collection ditch takes the weak brine to the mine area.

Once the brine is in the mine area, it is allowed to concentrate in one of three production areas. All of the brine concentration areas are sections of the prior open-pit mining operation that have been converted to evaporation basins.

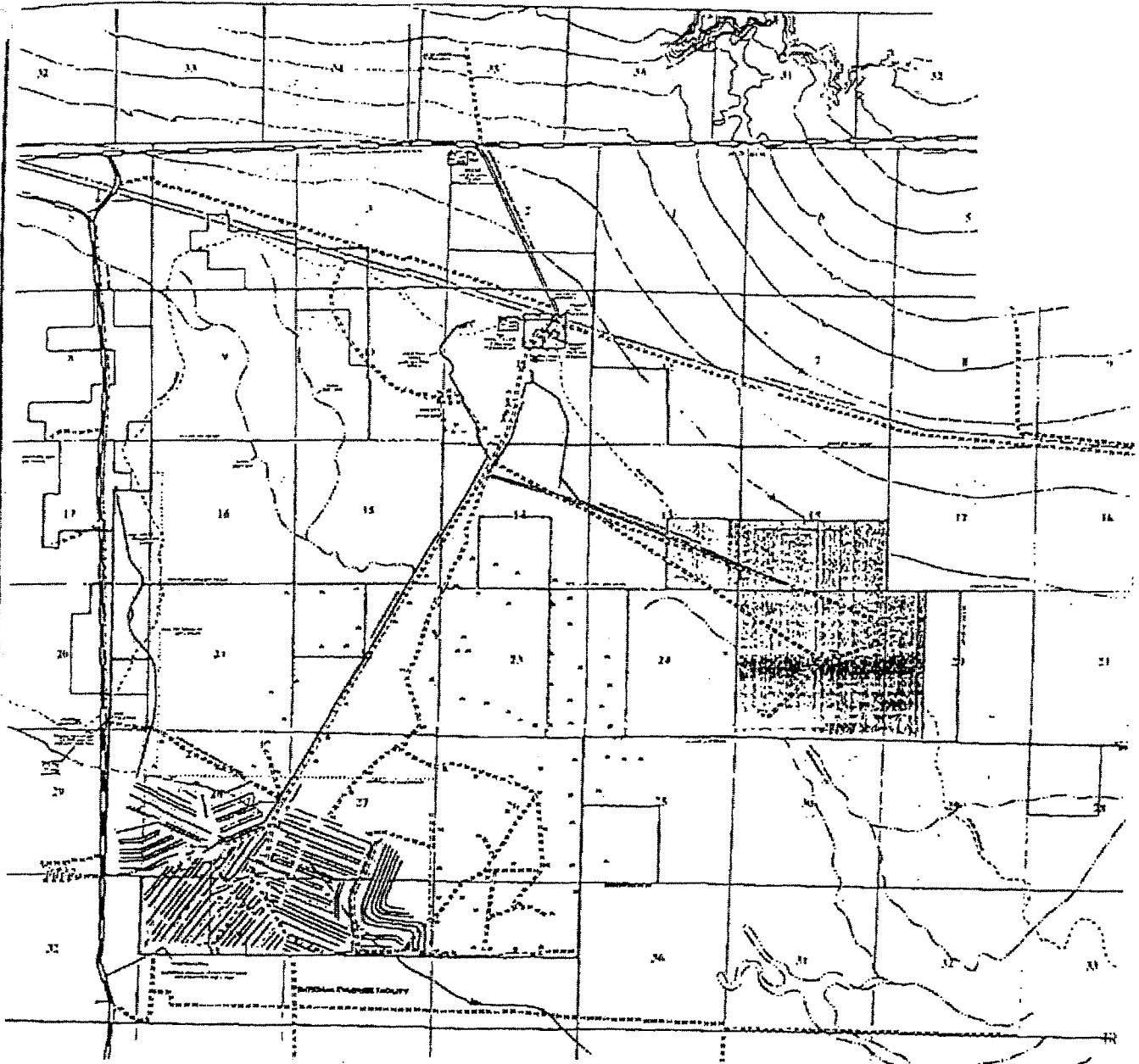
As the brine traverses the collection ditch, some concentration takes place. When the brine reaches the mine area, it is placed in a weak brine concentrator and allowed to concentrate. At the appropriate concentration the brine is pumped into a salt crystallizer. As the brine continues to concentrate, salt crystallizes out on the bottom of the crystallizer. The majority of the salt is collected in the crystallizers before the brine is advanced.

Brine leaving the crystallizers is generally treated with lime to remove magnesium. Alternatively the brine is left untreated and allowed to concentrate further for sale as untreated material. The lime-treated brine is placed in settling basins, where the magnesium solids are allowed to settle out. When the treated or untreated brines reach marketable concentrations they are stored in finished product ponds.

Pumping of the brine is done with centrifugal type pumps. The more frequently operated pumps are electric; others are diesel driven portable pumps. Interconnecting pipelines are made of a combination of steel and hi-density polyethylene.

The crystallized salt is harvested by draining the crystallizer, loosening the salt with a bulldozer, and picking up the salt with an elevating scraper. Once the salt is harvested, it is de-lumped and washed prior to sale. The de-lumper is a basic hammer mill. The salt washer is a sand screw utilizing countercurrent flow of wash solution that removes calcium sulfate precipitates.

A rubber-tired loader is used to load dump trucks. Pneumatic haul trucks are loaded using the loader and a conveyor/chute assembly. All of the equipment used in the process is of the semi-portable design found in much of the sand and gravel industry. All trucks leaving the site are weighted on a platform scale near the northern entrance to insure that they are not overloaded.



TETRA TECH, INC - MINING PLOT PLAN



**TETRA Technologies, Inc.**  
**Hi-Cal (Untreated Liquid Calcium Chloride)**  
**Process Description**



TETRA manufactures Hi-Cal (untreated liquid calcium chloride) by solar evaporation of naturally occurring brines. The brines containing primarily sodium chloride, calcium chloride, and magnesium chloride are pumped from well to a series of solar evaporation ponds. In the first group of ponds the brine is concentrated until nearly saturated with sodium chloride. The material is then transferred to a second group of ponds called salt crystallizers.

In the second group of ponds the brine continues to concentrate by solar evaporation. As the concentration increases, the brine becomes saturated and sodium chloride, or salt, begins to crystallize and settle to the bottom of the pond. After most of the salt is removed, the remaining brine contains primarily calcium chloride with small amounts of potassium, sodium, and magnesium chlorides. This brine is transferred to a third set of ponds where it is evaporated to the final product concentration. From these ponds it is finally transferred to product storage ponds and tanks where it is ready for sale.

After the brine is removed from the salt crystallizing ponds, the salt is harvested and washed with water to remove any remaining calcium chloride brine. The salt is then air dried and is then ready for sale as bulk solar salt.

The calcium chloride brine in the product storage facilities is called untreated liquid calcium chloride or Hi-Cal. It is a clear liquid that contains about 35% calcium chloride (32-40%) with small amounts of potassium, sodium, and magnesium chlorides; balance – water. The product has a density of about 11.5 lbs/gallon, and a pH of about 5. It is transported to customers via bulk tank trailers or railroad tank cars.

Kind regards,

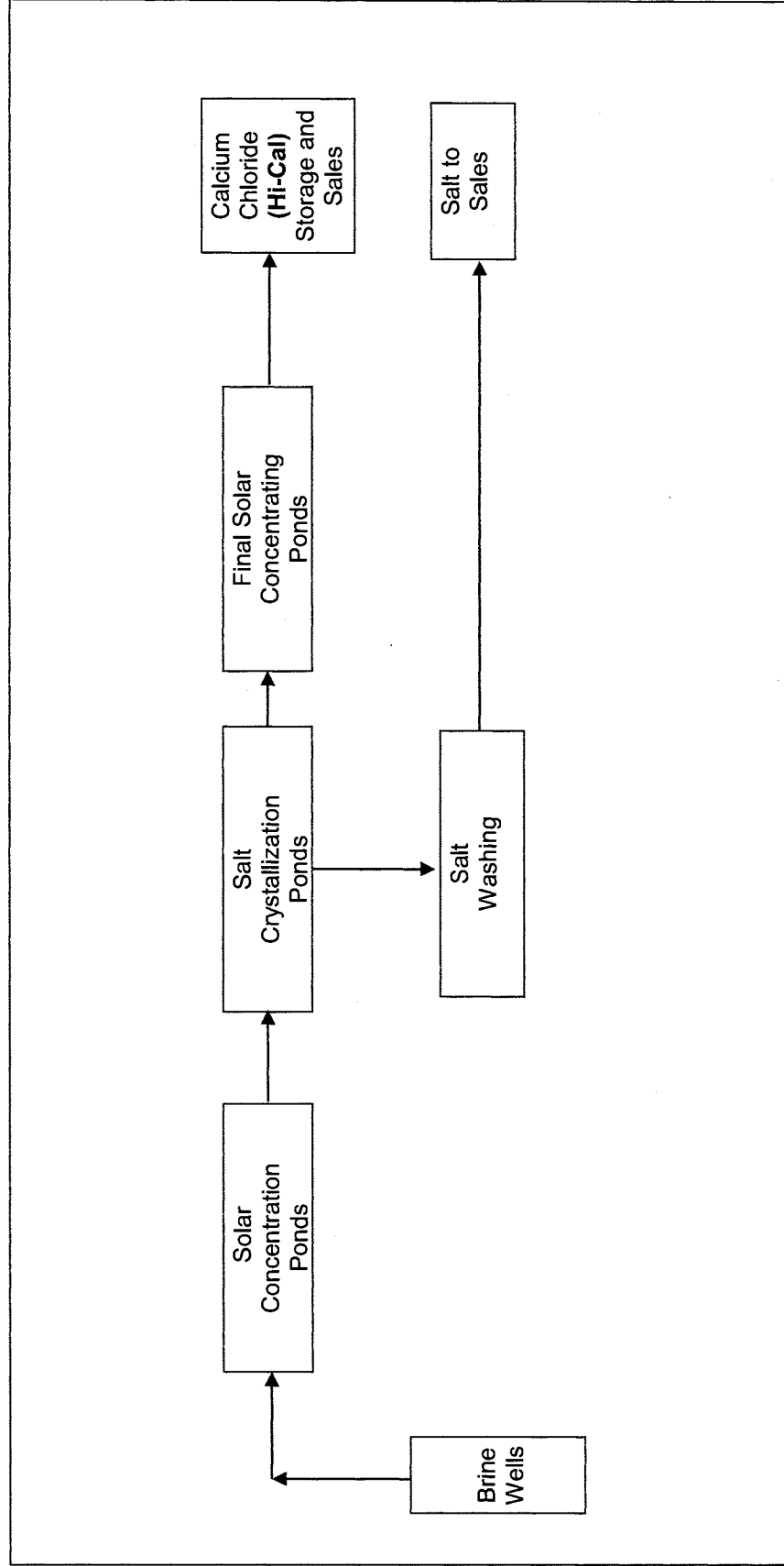
A handwritten signature in black ink, appearing to read "JR", written over a horizontal line.

Jennifer D. Ross  
Quality Assurance Manager





**TETRA Technologies, Inc.**  
**Hi-Cal (Untreated Liquid Calcium Chloride Production)**  
**Block Flow Diagram**





## **Appendix B**

- NOSB Committee Recommendation (09/06/2006)

FORMAL RECOMMENDATION BY THE  
NATIONAL ORGANIC STANDARDS BOARD (NOSB)  
TO THE NATIONAL ORGANIC PROGRAM (NOP)

Date: 11-25-06

Subject: Calcium Chloride - Crops.

Chair: Kevin O'Reil

Recommendation

The NOSB hereby recommends to the NOP the following:

Rulemaking Action: \_\_\_\_\_

Guidance Statement: \_\_\_\_\_

Other: \_\_\_\_\_

XXX

Statement of the Recommendation (including Recount of Vote):

The Crops Committee recommends that the NOSB reject a petitioners request for the addition of Calcium Chloride for use in Crop Production.

NOSB Vote:

Motion: Gerald Davis

Second: Nancy Outguy

Yes - 3

No - 3

Abstain - 3

Absent - 0

Rationale Supporting Recommendation (including consistency with OFPA and NOP):

The NOSB found that this material failed the attached evaluation criteria. See attached for details.

Response by the NOP:

# NOSB COMMITTEE RECOMMENDATION

Form NOPLIST1. Committee Transmittal to NOSB

For NOSB Meeting: <u>October 17-19, 2006</u>	Substance: <u>Calcium chloride- Annotation change</u>																				
Committee: Crops <input checked="" type="checkbox"/> Livestock <input type="checkbox"/> Handling <input type="checkbox"/>																					
<p><b>A. Evaluation Criteria (Documentation attached; committee recommendation attached)</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"></td> <td style="text-align: right; font-weight: bold;">Criteria Satisfied?</td> </tr> <tr> <td>1. Impact on humans and environment</td> <td style="text-align: right;">Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (see B below)</td> </tr> <tr> <td>2. Availability criteria</td> <td style="text-align: right;">Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (see B below)</td> </tr> <tr> <td>3. Compatibility &amp; consistency</td> <td style="text-align: right;">Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (see B below)</td> </tr> </table>			Criteria Satisfied?	1. Impact on humans and environment	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (see B below)	2. Availability criteria	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (see B below)	3. Compatibility & consistency	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (see B below)												
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3. Compatibility & consistency	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (see B below)																				
<p><b>B. Substance fails criteria?</b></p> <p>Criteria category: <u>1,2,3</u></p> <p>Comments: 1: See Category 1, Ques. 2,3 2: See Category 2, Question 7, 9 3: See Category 3, Question 2, 3</p>	<p><b>C. Proposed Annotation:</b> _____</p> <p>_____</p> <p>Basis for annotation:</p> <p>To meet criteria above: _____ Criteria: _____</p> <p>Other regulatory criteria: _____ Citation: _____</p>																				
<p><b>D. Recommended Committee Action &amp; Vote:</b> Motion by: _____</p> <p style="text-align: center;">Seconded: _____</p>																					
<p>Vote:</p> <p>Yes: <u>3</u></p> <p>No: <u>0</u></p> <p>Abstain: _____</p>	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Agricultural</td> <td style="padding: 2px;">Nonagricultural</td> <td style="padding: 2px; text-align: center;"><b>X</b></td> <td style="padding: 2px;">Crops</td> <td style="padding: 2px; text-align: center;"><b>X</b></td> </tr> <tr> <td style="padding: 2px;">Synthetic</td> <td style="padding: 2px;">Not synthetic</td> <td style="padding: 2px; text-align: center;"><b>X</b></td> <td style="padding: 2px;">Livestock</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;">Allowed<sup>1</sup></td> <td style="padding: 2px;">Prohibited<sup>2</sup></td> <td style="padding: 2px;"></td> <td style="padding: 2px;">Handling</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;">No restriction</td> <td style="padding: 2px;">Deferred<sup>4</sup></td> <td style="padding: 2px;"></td> <td style="padding: 2px;">Rejected<sup>3</sup></td> <td style="padding: 2px;"></td> </tr> </table>	Agricultural	Nonagricultural	<b>X</b>	Crops	<b>X</b>	Synthetic	Not synthetic	<b>X</b>	Livestock		Allowed <sup>1</sup>	Prohibited <sup>2</sup>		Handling		No restriction	Deferred <sup>4</sup>		Rejected <sup>3</sup>	
Agricultural	Nonagricultural	<b>X</b>	Crops	<b>X</b>																	
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Allowed <sup>1</sup>	Prohibited <sup>2</sup>		Handling																		
No restriction	Deferred <sup>4</sup>		Rejected <sup>3</sup>																		
<p>Annotation: _____</p> <p>_____</p> <p>2—substance to be added to "prohibited" paragraph of National List</p> <p>Describe why a prohibited substance: _____</p> <p>_____</p> <p>3—substance was rejected by vote for amending National List</p> <p>Describe why material was rejected: <u>See comments referenced in Section B above.</u></p> <p>_____</p> <p>4-substance was recommended to be deferred</p> <p>Describe why deferred; if follow-up is needed. If follow-up needed, who will follow up _____</p> <p>_____</p>																					
<p><b>E. Approved by Committee Chair to transmit to NOSB:</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border-bottom: 1px solid black;"><u>Gerry Davis, Crops</u></td> <td style="width: 50%; border-bottom: 1px solid black;"><u>09/06/06</u></td> </tr> <tr> <td style="border-bottom: 1px solid black;">Committee Chair</td> <td style="border-bottom: 1px solid black;">Date</td> </tr> </table>		<u>Gerry Davis, Crops</u>	<u>09/06/06</u>	Committee Chair	Date																
<u>Gerry Davis, Crops</u>	<u>09/06/06</u>																				
Committee Chair	Date																				

EVALUATION CRITERIA FOR SUBSTANCES ADDED TO THE NATIONAL LIST

Category 1. Adverse impacts on humans or the environment?

Substance - Calcium chloride

Question	Yes	No	N/A	Documentation (TAP, petition, regulatory agency, other)
1. Are there adverse effects on environment from manufacture, use, or disposal? [§205.600 b.2]		X		Manufacture by natural brine process is a closed system using impurities to prepare other compounds. Typical use rate in soil has minimal potential to allow leaching of soluble chloride ions into surface or ground waters (TAP).
2. Is there environmental contamination during manufacture, use, misuse, or disposal? [§6518 m.3]	X			Use at moderate to high rates in soil increases potential to allow leaching of significant quantities of soluble calcium and chloride ions into surface or ground waters, potentially affecting aquatic organisms at high rates >1000mg/L (TAP)
3. Is the substance harmful to the environment? [§6517 c(1)(A)(i); 6517(c)(2)(A)(i)]	X			Same as question #2
4. Does the substance contain List 1, 2, or 3 inerts? [§6517 c(1)(B)(ii); 205.601(m)2]		X		
5. Is there potential for detrimental chemical interaction with other materials used? [§6518 m.1]		X		TAP (Evaluation question #6)
6. Are there adverse biological and chemical interactions in agro-ecosystem? [§6518 m.5]	X	X		Typical use rates for calcium and/or chloride nutrition pose no significant adverse effects. Misuse can damage foliage (tipburn, browning) due to excess uptake of chloride (TAP).
7. Are there detrimental physiological effects on soil organisms, crops, or livestock? [§6518 m.5]	X	X		High levels of chloride ion may have the potential to impact organisms or roots in soil (TAP). Modest soil application rates would not be expected to bring chloride levels to ecologically damaging levels.
8. Is there a toxic or other adverse action of the material or its breakdown products? [§6518 m.2]	X	X		Same as questions 6 and 7.
9. Is there undesirable persistence or concentration of the material or breakdown products in environment? [§6518 m.2]		X		TAP (question #10)
10. Is there any harmful effect on human health? [§6517 c(1)(A)(i); 6517 c(2)(A)(i); §6518 m.4]	X			Skin and eye exposure to calcium chloride can lead to irritation and burns. Inhaled dusts or mists can cause upper respiratory tract irritation. (TAP)
11. Is there an adverse effect on human health as defined by applicable Federal regulations? [205.600 b.3]			X	
12. Is the substance GRAS when used according to FDA's good manufacturing practices? [§205.600 b.5]			X	
13. Does the substance contain residues of heavy metals or other contaminants in excess of FDA tolerances? [§205.600 b.5]			X	

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

**Category 2. Is the Substance Essential for Organic Production?** Substance - Calcium chloride

Question	Yes	No	N/A	Documentation (TAP, petition, regulatory agency, other)
1. Is the substance formulated or manufactured by a chemical process? [6502 (21)]		X		Natural brine process only. (TAP)
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)]		X		Natural brine process only (TAP).
3. Is the substance created by naturally occurring biological processes? [6502 (21)]		X		
4. Is there a natural source of the substance? [§205.600 b.1]			X	
5. Is there an organic substitute? [§205.600 b.1]			X	
6. Is the substance essential for handling of organically produced agricultural products? [§205.600 b.6]			X	
7. Is there a wholly natural substitute product? [§6517 c (1)(A)(ii)]	X	X		Yes. Limestone, gypsum, rock phosphate, bone meal.(TAP) Potassium chloride(as a chloride supplement) No. Soil applied materials such as these fail to supply calcium in sufficient quantities under conditions of limited calcium uptake.(TAP)
8. Is the substance used in handling, not synthetic, but not organically produced? [§6517 c (1)(B)(iii)]			X	
9. Is there any alternative substances? [§6518 m.6]	X			Calcium chelated with humic acids (TAP) or chelated with Amino acids (Albion Labs)
10. Is there another practice that would make the substance unnecessary? [§6518 m.6]		X		Alternative practices do not increase the translocation of calcium to growing points of the plant (TAP).

<sup>1</sup>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 – Calcium chloride

Question	Yes	No	N/A <sup>1</sup>	Documentation (TAP, petition, regulatory agency, other)
1. Is the substance compatible with organic handling? [§205.600 b.2]			X	
2. Is the substance consistent with organic farming and handling? [§6517 c (1)(A)(iii); 6517 c (2)(A)(ii)]	X	X		Lower rate foliar applications minimize the effects of possible chloride contamination of soil and water. Higher potential soil application rates invite surface or groundwater contamination issues conflicting with §205.203(d) of the Rule.
3. Is the substance compatible with a system of sustainable agriculture? [§6518 m.7]	X	X		For the very long term, the natural resource material is not renewable, though currently plentiful. For ground water and surface water contamination concerns, limiting the use rate per acre mitigates possible conflicts with sustainable agriculture principles.
4. Is the nutritional quality of the food maintained with the substance? [§205.600 b.3]			X	
5. Is the primary use as a preservative? [§205.600 b.4]			X	
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]			X	
7. Is the substance used in production, and does it contain an active synthetic ingredient in the following categories:			X	Calcium chloride produced by natural brine process is non-synthetic.
a. copper and sulfur compounds;				
b. toxins derived from bacteria;				
c. pheromones, soaps, horticultural oils, fish emulsions, treated seed, vitamins and minerals?				
d. livestock parasiticides and medicines?				
e. production aids including netting, tree wraps and seals, insect traps, sticky barriers, row covers, and equipment cleaners?				

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

# NOP's Internal Review



## Eligibility review of previously petitioned/rejected materials

- NOP reviews previous petition and technical report(s) for the substance
- NOP identifies why the substance was prohibited
- NOP reviews new petition for any information that was not submitted in an earlier petition or provided in the technical report
- No new information
  - Petitioner is notified that substance was previously reviewed and rejected and that no new information was provided
- New information
  - Petition proceeds to NOSB review. NOP does not determine whether the new information would be likely to warrant a change in decision

**\*\*Important that NOSB recommendations to reject petitions also contain sufficient justification\*\***

## **Appendix C**

- States Calcium Chloride is Registered as a Fertilizer Under the Category of Agricultural Mineral



**States Calcium Chloride is Registered as a Fertilizer  
Under the Category of Agricultural Mineral**



Arizona  
Arkansas  
California  
Colorado  
Florida  
Georgia  
Idaho  
Iowa  
Kansas  
Kentucky  
Mississippi  
Missouri  
Nebraska  
Nevada  
New Mexico  
North Carolina  
Oklahoma  
Oregon  
Pennsylvania  
Texas  
Washington  
Wisconsin

## **Appendix D**

- Product Data Sheet: Hi-Cal Liquid Calcium
- Label: Hi-Cal Liquid Calcium



# HI-CAL LIQUID CALCIUM

## Product Data Sheet

### General Description

Hi-Cal™ liquid calcium is a 100% water soluble, clear liquid solution with 12 percent calcium.

As water quality declines due to increasing salinity, crops can experience injury and reduced yields. A cost effective, easy to use solution for dealing with poor water quality is TETRA's Hi-Cal liquid calcium.

### Applications

Hi-Cal liquid calcium is used to solve problems associated with soils and water, especially under irrigated conditions. In addition to being a stand alone water amendment product, Hi-Cal liquid calcium is also used to formulate N-Cal® and Sodex®, TETRA's fertilizer and turf product lines. Hi-Cal liquid calcium can also be blended with solutions containing nitrogen, potassium, and micronutrients derived from chloride or chelated sources.

Besides providing calcium for plant nutrition and sodium displacement, Hi-Cal liquid calcium is a valuable source of chloride fertilization. Extensive university studies confirm that chloride fertilization helps to suppress many soil-borne and plant tissue diseases on crops such as wheat, barley, corn, potatoes, and rice. Correcting chloride deficiencies can help maximize crop yield and grower profits.

Hi-Cal liquid offers many advantages over other calcium sources such as gypsum as it:

- Is fast acting,
- Is 100% water soluble,
- Is safe and easy to handle,
- Is economical, with low application rates,
- May be mixed with herbicides,
- May be applied through irrigation systems, and
- Is a nonhazardous liquid.

### TETRA Chemicals

24955 Interstate 45 North  
The Woodlands, Texas 77380

Phone: 281.367.1983

Customer Service: 800.327.7817

Fax: 281.298.7150

[www.tetrachemicals.com](http://www.tetrachemicals.com)

Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other governmental enactments. Seller assumes no obligation or liability for the information in this document. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED. Further, nothing contained herein shall be taken as a recommendation to manufacture or use any of the herein described materials or processes in violation of existing or future patents.

### Availability

Hi-Cal liquid calcium is available in bulk only.

### Safety and Handling

Hi-Cal liquid calcium is a strong calcium chloride salt solution. Wear appropriate protective, impervious clothing. Wear safety glasses with non-flexible side shields or chemical goggles for proper protection of the eyes. Wear appropriate protective non-leather protective gloves and boots such as PVC or Nitrile are recommended. Leather products do not offer adequate protection and will dehydrate with resultant shrinkage and possible destruction. This product should be handled in areas with proper ventilation. Before using this product, refer to the SDS which is available on the company's website for complete safety and handling guidelines.

### CHEMICAL PROPERTIES

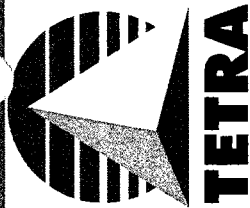
Chemical	CaCl <sub>2</sub>
Appearance	Clear to straw liquid solution
Odor	None
Assay	Typically 12% by weight Ca
Density	Approx. 11.09 lb/gal
pH	7.0

### TYPICAL ANALYSIS\*

Guaranteed Analysis Calcium (Ca)	12% by weight
Chloride (Cl)	22 to 26% by weight
Arsenic (As)	< 5 mg/kg
Heavy Metals (including Pb)	< 20 mg/kg
Cobalt (Co)	< 10 mg/kg
Lead (Pb)	< 10 mg/kg

\*Impurities based on 100% CaCl<sub>2</sub> basis

TETRA



# HI-CAL™ LIQUID CALCIUM

*For Calcium and Chloride Nutrition in Crops and for Soil  
Amendment and Irrigation Water*

**EMERGENCY TELEPHONE NUMBER**  
CHEMTREC 800.424.9300 (24 Hours)

TETRA Technologies, Inc.  
24955 Interstate 45 North  
The Woodlands, Texas 77380  
Phone: 800.327.7817

Net Weight: Bulk  
Minimum Weight Per Gallon = 11.3 lbs.  
GUARANTEED ANALYSIS  
Calcium (Ca).....12%  
Derived from Calcium Chloride  
Chloride (Cl) not more than 26%

Information regarding the contents and levels of metals in this product is available on the internet at: <http://www.aapfco.org/metals.htm>

#### CONDITIONS OF SALE

- Seller warrants that this product consists of the ingredients specified and is reasonably fit for the purpose stated on this label when used in accordance with direction under normal conditions of use. No one, other than an officer of Seller, is authorized to make any warranty, guarantee, or direction concerning this product.
- Because the time, place, rate of application, and other conditions of use are beyond Seller's control, Seller's liability from handling, storage, and use of this product is limited to replacement of product or refund of purchase price.

#### CAUTION:

**Keep Out of Reach of Children**  
Contact Sales and Technical Support  
for specific recommendations.

#### STORAGE AND USE PRECAUTIONS

##### GENERAL:

Avoid mixing with phosphorus or sulfur containing materials, as precipitation may occur.

##### TANKS:

- Store in polyolefin or polyethylene storage tanks.
- If fiberglass is used, consult manufacturer for compatibility.
- Do not store for extended periods of time in mild steel tanks.
- Although stainless steel tanks are less prone to corrosion than mild steel tanks, they are not recommended for extended storage.

##### FITTINGS AND VALVES:

- PVC or polypropylene fittings and valves are recommended.
- Do not use nylon fittings and valves.

##### WARNINGS:

- Harmful if swallowed.
- Avoid breathing spray mist.
- May cause irritation of nose, throat, and/or skin.
- Avoid contact with eyes, skin, and clothing.
- **If swallowed:** If victim is conscious, have victim drink water or milk. Never give anything by mouth to an unconscious person. Get medical attention.
- **If in eyes:** Wash eyes with plenty of clear water for at least 15 minutes. Get medical attention.

**DO NOT MIX WITH PHOSPHATE OR  
SULFUR CONTAINING SOLUTIONS**



# HI-CAL™ LIQUID CALCIUM

*For Calcium and Chloride Nutrition in Crops and for Soil  
Amendment and Irrigation Water*

**EMERGENCY TELEPHONE NUMBER**  
CHEMTREC 800.424.9300 (24 Hours)  
  
TETRA Technologies, Inc.  
24955 Interstate 45 North  
The Woodlands, Texas 77380  
Phone: 800.327.7817

## RECOMMENDED APPLICATION RATES

### Peanuts:

20 gallons per acre applied with premerge herbicide before peanuts emerge

OR

20 gallons per acre applied through irrigation water 0-60 days after planting

### Cotton:

8 gallons per acre applied with premerge herbicide or alone before cotton emerges

OR

8 gallons per acre applied with nitrogen solutions or direct at side dress

### Corn:

6 to 12 gallons per acre applied with nitrogen source

### Wheat:

4 to 8 gallons per acre applied direct to the wheat or tank mix with liquid nitrogen source

## RECOMMENDED APPLICATION RATES

For soil and irrigation water amendment.

### **For Soil Amendment:**

Apply 25 gallons per acre of Hi-Cal liquid calcium for every ton of gypsum recommended on the soil analysis report.

### **For Irrigation Water Amendment:**

Apply 10 to 15 gallons of Hi-Cal liquid calcium through the irrigation water beginning in early spring or as needed to prevent excessive run-off or excess standing water. May be repeated as necessary to maintain good water penetration and to prevent the buildup of harmful sodium salts. A typical application is between 25 and 50 gallons per acre, per season, depending on soil conditions.

### **For Calcium Fertilization:**

Mix Hi-Cal with nitrogen solutions (such as UN 32, or urea solution) at a ratio of 3 parts nitrogen to 1 part calcium. Apply at standard application timings for side dress or later season water run applications. May be applied alone.

### **Approved for Organic Applications as Follows (OMRI listed):**

Apply at rates recommended by local agricultural experts as a foliar spray to treat a physiological disorder associated with calcium uptake. Use a minimum dilution of 10:1.

## **Appendix E**

- Safety Data Sheet: Hi-Cal Liquid Calcium Chloride
- Envirofacts Master Chemical Integrator (EMCI): Calcium Chloride Dihydrate (CAS# 10035-04-8) – updated May 23, 2002



# SAFETY DATA SHEET

Issuing Date 10-Dec-2014

Revision Date 10-Dec-2014

Revision Number 0

## 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

### GHS product identifier

**Product Name** Hi-Cal™ Liquid Calcium Chloride

### Other means of identification

**Synonyms** Liquid Calcium Chloride

### Recommended use of the chemical and restrictions on use

**Recommended Use** For Agriculture Applications

**Uses advised against** No information available

### Supplier's details

#### **Supplier Address**

TETRA Technologies, Inc.  
24955 Interstate 45 North  
The Woodlands, TX 77380  
TEL: 281-367-1983 (Non-Emergency Number)

### Emergency telephone number

**Emergency Telephone Number** CHEMTREC: 1-800-424-9300 for US/ 703-527-3887 outside US

## 2. HAZARDS IDENTIFICATION

### Classification

Serious Eye Damage/Eye Irritation

Category 2

### GHS Label elements, including precautionary statements

### Emergency Overview

#### **Signal Word**

#### **Warning**

#### **Hazard Statements**

- May be harmful if swallowed
- Causes serious eye irritation
- Harmful to aquatic life with long lasting effects



**Appearance** Colorless to amber      **Physical State** Liquid.      **Odor** Odorless

**Precautionary Statements**

**Prevention**

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear eye/face protection.

**General Advice**

- None

**Eyes**

- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If eye irritation persists: Get medical advice/attention.

**Storage**

- None

**Disposal**

- None

**Hazard Not Otherwise Classified (HNOC)**

Not applicable

**Other information**

Harmful to aquatic life Harmful to aquatic life with long lasting effects

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

**Synonyms** Liquid Calcium Chloride

Chemical Name	CAS-No	Weight %	Trade secret
Calcium Chloride	10043-52-4	32-40	*

*\*The exact percentage (concentration) of composition has been withheld as a trade secret.*

**4. FIRST AID MEASURES**

**Description of necessary first-aid measures**

- General Advice** If symptoms persist, call a physician.
- Eye Contact** Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Keep eye wide open while rinsing. If symptoms persist, call a physician.
- Skin Contact** Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. If symptoms persist, call a physician.
- Inhalation** Move to fresh air in case of accidental inhalation of vapors. Remove from exposure, lie down. If symptoms persist, call a physician.



**Ingestion** Rinse mouth. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. If symptoms persist, call a physician.

**Most important symptoms/effects, acute and delayed**

**Most Important Symptoms/Effects** Irritation.

**Indication of immediate medical attention and special treatment needed, if necessary**

**Notes to Physician** Treat symptomatically.

## 5. FIRE-FIGHTING MEASURES

**Suitable Extinguishing Media**

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

**Unsuitable Extinguishing Media** No information available.

**Specific Hazards Arising from the Chemical**

No information available.

**Explosion Data**

**Sensitivity to Mechanical Impact**

None.

**Sensitivity to Static Discharge**

None.

**Protective Equipment and Precautions for Firefighters**

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

## 6. ACCIDENTAL RELEASE MEASURES

**Personal precautions, protective equipment and emergency procedures**

**Personal Precautions** Avoid contact with the skin and the eyes. Ensure adequate ventilation. Keep people away from and upwind of spill/leak. Do not touch or walk through spilled material.

**Environmental Precautions**

**Environmental Precautions** Avoid release to the environment. Dispose of contents/container to an approved waste disposal plant. See Section 12 for additional Ecological Information.

**Methods and materials for containment and cleaning up**

**Methods for Containment** Prevent further leakage or spillage if safe to do so. Dike far ahead of spill; use dry sand to contain the flow of material

**Methods for Cleaning Up** Soak up with inert absorbent material. Pick up and transfer to properly labeled containers. After cleaning, flush away traces with water. Prevent product from entering drains.

## 7. HANDLING AND STORAGE

**Precautions for safe handling**

**Handling** Handle in accordance with good industrial hygiene and safety practice. Wear personal protective equipment. Avoid contact with skin, eyes and clothing. Do not breathe vapors or spray mist.

**Conditions for safe storage, including any incompatibilities**

**Storage** Keep containers tightly closed in a cool, well-ventilated place. Keep in properly labeled containers.

**Incompatible Products** None known based on information supplied.

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

### Control parameters

#### Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Calcium Chloride 10043-52-4	ACGIH - (TLV-TWA) Guideline for nuisance particulate (inhalable particulate): 10 mg/m <sup>3</sup>	OSHA (PEL-TWA) - Z-3 Mineral Dusts, Inert or Nuisance dusts, (respirable fraction): 5 mg/m <sup>3</sup>	-

#### Appropriate engineering controls

#### Engineering Measures

When there is a potential for exposure, an emergency eyewash and safety shower should be provided within the immediate work area.

#### Individual protection measures, such as personal protective equipment

#### Eye/Face Protection

Wear safety glasses with non-flexible side shields or chemical goggles. A face shield should be worn if a potential for splashing or spraying exists.

#### Skin and Body Protection

Wear appropriate protective, impervious clothing. Wear appropriate protective non-leather protective gloves and boots. Chemical protective gloves and boots such as PVC, Neoprene, or Heavy Nitrile are recommended. Leather products do not offer adequate protection and will dehydrate with resultant shrinkage and possible destruction.

#### Respiratory Protection

A respirator is not indicated under normal operating conditions. Use of a NIOSH - approved respirator (N95 or greater) should be based on the presence of nuisance dusts.

#### Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

### Information on basic physical and chemical properties

Physical State	Liquid	Appearance	Colorless to amber
Odor	Odorless	Odor Threshold	No information available

<u>Property</u>	<u>Values</u>	<u>Remarks/ - Method</u>
pH	3.8 - 9.0	None known
Melting Point/Range	Not determined	None known
Boiling Point/Boiling Range	118 °C / 244 °F	for 38% liquid solution
Flash Point	Not applicable.	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limits in Air		
upper flammability limit	No data available	
lower flammability limit	No data available	
Vapor Pressure	No data available	None known
Vapor Density	No data available	None known
Specific Gravity	1.376 @ 25 C (77 F) for 38% solution	None known
Water Solubility	Completely soluble	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition Temperature	No data available	None known
Decomposition Temperature	No data available	None known
Viscosity	No data available	None known

#### Flammable Properties

Not flammable

#### Explosive Properties

No data available

#### Oxidizing Properties

No data available

### Other information

#### VOC Content (%)

Not applicable.

**10. STABILITY AND REACTIVITY**

**Reactivity**

No data available.

**Chemical stability**

Stable under recommended storage conditions.

**Possibility of hazardous reactions**

None under normal processing.

**Hazardous Polymerization**

Hazardous polymerization does not occur.

**Conditions to avoid**

None known based on information supplied.

**Incompatible materials**

None known based on information supplied.

**Hazardous decomposition products**

None known based on information supplied.

**11. TOXICOLOGICAL INFORMATION**

**Information on likely routes of exposure**

**Product Information**

<b>Inhalation</b>	May cause irritation.
<b>Eye Contact</b>	Irritating to eyes.
<b>Skin Contact</b>	Slightly toxic by dermal absorption.
<b>Ingestion</b>	Moderately toxic by ingestion.

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Calcium Chloride	= 1000 mg/kg ( Rat )	= 2630 mg/kg ( Rat )	-

**Symptoms related to the physical, chemical and toxicological characteristics**

**Symptoms** No information available.

**Delayed and immediate effects and also chronic effects from short and long term exposure**

<b>Sensitization</b>	No information available.
<b>Mutagenic Effects</b>	No information available.
<b>Carcinogenicity</b>	Contains no ingredients above reportable quantities listed as a carcinogen.

<b>Reproductive Toxicity</b>	No information available.
<b>STOT - single exposure</b>	No information available.
<b>STOT - repeated exposure</b>	No information available.
<b>Aspiration Hazard</b>	No information available.

**Numerical measures of toxicity - Product**

The following values are calculated based on chapter 3.1 of the GHS document:

LD50 Oral 2413 mg/kg; Acute toxicity estimate  
 LD50 Dermal 6490 mg/kg; Acute toxicity estimate  
 Inhalation dust/mist 2100000 mg/L; Acute toxicity estimate

**12. ECOLOGICAL INFORMATION**

Ecotoxicity

The environmental impact of this product has not been fully investigated.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
Calcium Chloride 10043-52-4		LC50 96 h: = 10650 mg/L static (Lepomis macrochirus)		LC50 48 h: = 2400 mg/L (Daphnia magna)

**Persistence and Degradability** No information available.

**Bioaccumulation** No information available.

Other Adverse Effects

No information available.

**13. DISPOSAL CONSIDERATIONS**

**Waste Disposal Methods** This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.

**Contaminated Packaging** Do not re-use empty containers.

**14. TRANSPORT INFORMATION**

DOT Not regulated

**15. REGULATORY INFORMATION**

International Inventories

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory  
 DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

U.S. Federal Regulations

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No

Reactive Hazard

No

**Clean Water Act**

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

**CERCLA**

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

**U.S. State Regulations**

**California Proposition 65**

This product does not contain any Proposition 65 chemicals.

**U.S. State Right-to-Know Regulations**

**U.S. EPA Label Information**

EPA Pesticide Registration Number Not applicable

**16. OTHER INFORMATION**

<b>NFPA</b>	Health Hazard 1	Flammability 0	Instability 0	Physical and Chemical Hazards -
<b>HMIS</b>	Health Hazard 1	Flammability 0	Physical Hazard 0	Personal Protection X

Prepared By Product Stewardship  
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 Revision Note Initial Release.

**General Disclaimer**

The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet





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EMCI

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### CALCIUM CHLORIDE, DIHYDRATE

CAS #10035-04-8

**Envirofacts does not contain any references to information resources regarding this chemical.**

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Last updated on Thursday, May 23rd, 2002



## ChemIDplus Advanced

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**NAME: Calcium chloride [USAN:JAN]**  
**RN: 10035-04-8**



MW: 147.014

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 Last modified on September 9, 2004.



[Code of Federal Regulations]  
[Title 21, Volume 3]  
[Revised as of April 1, 2004]  
From the U.S. Government Printing Office via GPO Access  
[CITE: 21CFR184.1193]

[Page 491-492]

TITLE 21--FOOD AND DRUGS

CHAPTER I--FOOD AND DRUG ADMINISTRATION, DEPARTMENT OF HEALTH AND HUMAN SERVICES (CONTINUED)

PART 184 DIRECT FOOD SUBSTANCES AFFIRMED AS GENERALLY RECOGNIZED AS SAFE--Table of Contents

Subpart B Listing of Specific Substances Affirmed as GRAS

Sec. 184.1193 Calcium chloride.

(a) Calcium chloride ( $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ , CAS Reg. No. 10035-04-8) or anhydrous calcium chloride ( $\text{CaCl}_2$ , CAS Reg. No. 10043-52-4) may be commercially obtained as a byproduct in the ammonia-soda (Solvay) process and as a joint product from natural salt brines, or it may be prepared by substitution reactions with other calcium and chloride salts.

(b) The ingredient meets the specifications of the Food Chemicals Codex, 3d Ed. (1981), p. 47, which is incorporated by reference. Copies are available from the National Academy Press, 2101 Constitution Ave. NW., Washington, DC 20418, or available for inspection at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC 20408.

(c) The ingredient is used as an anticaking agent as defined in Sec. 170.3(o)(1) of this chapter; antimicrobial agent as defined in Sec. 170.3(o)(2) of this chapter; curing or pickling agent as defined in Sec. 170.3(o)(5) of this chapter; firming agent as defined in Sec. 170.3(o)(10) of this chapter; flavor enhancer as defined in Sec. 170.3(o)(11) of this chapter; humectant as defined in Sec. 170.3(o)(16) of this chapter; nutrient supplement as defined in Sec. 170.3(o)(20) of this chapter; pH control agent as defined in Sec. 170.3(o)(23) of this chapter; processing aid as defined in Sec. 170.3(o)(24) of this chapter; stabilizer and thickener as defined in Sec. 170.3(o)(28) of this chapter; surface-active agent as defined in Sec. 170.3(o)(29) of this chapter; synergist as defined in Sec. 170.3(o)(31) of this chapter; and texturizer as defined in Sec. 170.3(o)(32) of this chapter.

(d) The ingredient is used in foods at levels not to exceed current good manufacturing practices in accordance

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with Sec. 184.1(b)(1). Current good manufacturing practices result in a maximum level, as served, of 0.3 percent for baked goods as defined in Sec. 170.3(n)(1) of this chapter and for dairy product analogs as defined in Sec. 170.3(n)(10) of this chapter; 0.22 percent for nonalcoholic beverages and beverage bases as defined in Sec. 170.3(n)(3) of this chapter; 0.2 percent for cheese as defined in Sec. 170.3(n)(5) of this chapter and for processed fruit and fruit juices as defined in Sec. 170.3(n)(35) of this chapter; 0.32 percent for coffee and tea as defined in Sec. 170.3(n)(7) of this chapter; 0.4 percent for condiments and relishes as defined in Sec. 170.3(n)(8) of this chapter; 0.2 percent for gravies and sauces as defined in Sec. 170.3(n)(24) of this chapter; 0.1 percent for commercial jams and jellies as defined in Sec. 170.3(n)(28) of this chapter; 0.25 percent for meat products as defined in Sec. 170.3(n)(29) of this chapter; 2.0 percent for plant protein products as defined in Sec. 170.3(n)(33) of this chapter; 0.4 percent for processed vegetables and vegetable juices as defined in

Sec. 170.3(n)(36) of this chapter; and 0.05 percent for all other food categories.

(e) Prior sanctions for this ingredient different from the uses established in this section do not exist or have been waived.

[47 FR 27808, June 25, 1982, as amended at 61 FR 14247, Apr. 1, 1996]

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## Calcium Supplements (Systemic)


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### Contents of this page:

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### Brand Names

Some commonly used brand names are:

#### In the U.S.—

- Alka-Mints<sup>2</sup>
- Amitone<sup>2</sup>
- Calcarb 600<sup>2</sup>
- Calci-Chew<sup>2</sup>
- Calciday 667<sup>2</sup>
- Calcilac<sup>2</sup>
- Calci-Mix<sup>2</sup>
- Calcionate<sup>5</sup>
- Calcium 600<sup>2</sup>
- Calglycine<sup>2</sup>
- Calphosan<sup>8</sup>
- Cal-Plus<sup>2</sup>
- Caltrate 600<sup>2</sup>
- Caltrate Jr<sup>2</sup>
- Chooz<sup>2</sup>
- Citracal<sup>4</sup>
- Citracal Liquitabs<sup>4</sup>
- Dicarbosil<sup>2</sup>
- Gencalc 600<sup>2</sup>
- Liquid-Cal<sup>2</sup>
- Liquid Cal-600<sup>2</sup>
- Maalox Antacid Caplets<sup>2</sup>
- Mallamint<sup>2</sup>
- Neo-Calglucon<sup>5</sup>
- Nephro-Calci<sup>2</sup>
- Os-Cal 500<sup>2</sup>
- Os-Cal 500 Chewable<sup>2</sup>
- Oysco<sup>2</sup>
- Oysco 500 Chewable<sup>2</sup>
- Oyst-Cal 500<sup>2</sup>
- Oysterical 500<sup>2</sup>
- Posture<sup>12</sup>
- Rolaid's Calcium Rich<sup>2</sup>
- Titracal<sup>2</sup>
- Tums<sup>2</sup>
- Tums 500<sup>2</sup>
- Tums E-X<sup>2</sup>

#### In Canada—

- Apo-Cal<sup>2</sup>
- Calciject<sup>3</sup>
- Calcite 500<sup>2</sup>
- Calcium-Sandoz<sup>5</sup>
- Calcium-Sandoz Forte<sup>10</sup>
- Caltrate 600<sup>2</sup>
- Gramcal<sup>10</sup>
- Nu-Cal<sup>2</sup>
- Os-Cal<sup>2</sup>
- Os-Cal Chewable<sup>2</sup>

- Calcium Stanley<sup>§</sup>
- Calsan<sup>‡</sup>
- Tums Extra Strength<sup>‡</sup>
- Tums Regular Strength<sup>‡</sup>

**Note:** For quick reference, the following calcium supplements are numbered to match the corresponding brand names.

This information applies to the following:

- |  |  |
|--|--|
| 1. Calcium Acetate (KAL-see-um ASa-tate)†  | 8. Calcium Glycerophosphate and Calcium Lactate (KAL-see-um gliss-er-o-FOS-fate and KAL-see-um LAK-tate)†            |
| 2. Calcium Carbonate (KAL-see-um KAR-boh-nate)‡  | 9. Calcium Lactate (KAL-see-um LAK-tate)‡  |
| 3. Calcium Chloride (KAL-see-um KLOR-ide)‡   | 10. Calcium Lactate-Gluconate and Calcium Carbonate (KAL-see-um LAK-tate GLOO-coh-nate and KAL-see-um KAR-boh-nate)* |
| 4. Calcium Citrate (KAL-see-um SIH-trayt)‡‡  | 11. Dibasic Calcium Phosphate (dy-BAY-sic KAL-see-um FOS-fate)‡‡   |
| 5. Calcium Glubionate (KAL-see-um gloo-BY-oh-nate)§  | 12. Tribasic Calcium Phosphate (try-BAY-sic KAL-see-um FOS-fate)‡  |
| 6. Calcium Gluceptate and Calcium Gluconate (KAL-see-um gloo-SEP-tate and KAL-see-um GLOO-coh-nate)* | 13. Calcium Gluceptate (KAL-see-um gloo-SEP-tate)‡‡  |
| 7. Calcium Gluconate (KAL-see-um GLOO-coh-nate)‡   |  |

‡ Generic name product may be available in the U.S.

§ Generic name product may be available in Canada

\* Not commercially available in the U.S.

† Not commercially available in Canada

## Category

- **Antacid** –Calcium Carbonate
- **Antihyperkalemic** –Calcium Chloride ; Calcium Gluconate Injection
- **Antihypermagnesemic** – Calcium Chloride; Calcium Gluceptate; Calcium Gluconate Injection
- **Antihyperphosphatemic** –Calcium Carbonate ; Calcium Citrate
- **Antihypocalcemic** –Calcium Acetate ; Calcium Carbonate; Calcium Chloride; Calcium Citrate; Calcium Glubionate; Calcium Gluceptate; Calcium Gluconate; Calcium Glycerophosphate and Calcium Lactate; Calcium Lactate; Calcium Lactate-Gluconate and Calcium Carbonate; Calcium Phosphate, Dibasic; Calcium Phosphate, Tribasic
- **Cardiotonic** –Calcium Chloride; Calcium Gluconate Injection
- **Electrolyte replenisher** –Calcium Acetate; Calcium Chloride; Calcium Gluceptate; Calcium Gluconate Injection
- **Nutritional supplement, mineral** –Calcium Carbonate; Calcium Citrate; Calcium Glubionate, Oral ; Calcium Gluceptate and Calcium Gluconate ; Calcium Gluconate, Oral; Calcium Lactate; Calcium Lactate-Gluconate and Calcium Carbonate; Calcium Phosphate, Dibasic; Calcium Phosphate, Tribasic

## Description

Calcium supplements are taken by individuals who are unable to get enough calcium in their regular diet or who have a need for more calcium. They are used to prevent or treat several conditions that may cause hypocalcemia (not enough calcium in the blood). The body needs calcium to make strong bones. Calcium is also needed for the heart, muscles, and nervous system to work properly.

The bones serve as a storage site for the body's calcium. They are continuously giving up calcium to the bloodstream and then replacing it as the body's need for calcium changes from day to day. When there is not enough calcium in the blood to be used by the heart and other organs, your body will take the needed calcium from the bones. When you eat foods rich in calcium, the calcium will be restored to the bones and the balance between your blood and bones will be maintained.

Pregnant women, nursing mothers, children, and adolescents may need more calcium than they normally get from eating calcium-rich foods. Adult women may take calcium supplements to help prevent a bone disease called osteoporosis. Osteoporosis, which causes thin, porous, easily broken bones, may occur in women after menopause, but may sometimes occur in elderly men also. Osteoporosis in women past menopause is thought to be caused by a reduced amount of ovarian estrogen (a female hormone). However, a diet low in

calcium for many years, especially in the younger adult years, may add to the risk of developing it. Other bone diseases in children and adults are also treated with calcium supplements.

Calcium supplements may also be used for other conditions as determined by your health care professional.

Injectable calcium is administered only by or under the supervision of your health care professional. Other forms of calcium are available without a prescription.

Calcium supplements are available in the following dosage forms:

*Oral*

- Calcium Carbonate
  - Capsules (U.S. and Canada)
  - Oral suspension (U.S.)
  - Tablets (U.S. and Canada)
  - Chewable tablets (U.S. and Canada)
- Calcium Citrate
  - Tablets (U.S.)
  - Tablets for solution (U.S.)
- Calcium Glubionate
  - Syrup (U.S. and Canada)
- Calcium Gluceptate and Calcium Gluconate
  - Oral solution (Canada)
- Calcium Gluconate
  - Tablets (U.S. and Canada)
  - Chewable tablets (U.S.)
- Calcium Lactate
  - Tablets (U.S. and Canada)
- Calcium Lactate-Gluconate and Calcium Carbonate
  - Tablets for solution (Canada)
- Dibasic Calcium Phosphate
  - Tablets (U.S.)
- Tribasic Calcium Phosphate
  - Tablets (U.S.)

*Parenteral*

- Calcium Acetate
  - Injection (U.S.)
- Calcium Chloride
  - Injection (U.S. and Canada)
- Calcium Glubionate
  - Injection (Canada)
- Calcium Gluceptate
  - Injection (U.S.)
- Calcium Gluconate
  - Injection (U.S. and Canada)
- Calcium Glycerophosphate and Calcium Lactate
  - Injection (U.S.)

A calcium "salt" contains calcium along with another substance, such as carbonate or gluconate. Some calcium salts have more calcium (elemental calcium) than others. For example, the amount of calcium in calcium carbonate is greater than that in calcium gluconate. To give you an idea of how different calcium supplements vary in calcium content, the following chart explains how many tablets of each type of supplement will provide 1000 milligrams of elemental calcium. When you look for a calcium supplement, be sure the number of milligrams on the label refers to the amount of elemental calcium, and not to the strength of each tablet.

Calcium supplement	Strength of each tablet (in milligrams)	Amount of elemental calcium per tablet (in milligrams)	Number of tablets to provide 1000 milligrams of calcium
Calcium carbonate	625	250	4
	650	260	4
	750	300	4

	835	334	3
	1250	500	2
	1500	600	2
Calcium citrate	950	200	5
Calcium gluconate	500	45	22
	650	58	17
	1000	90	11
Calcium lactate	325	42	24
	650	84	12
Calcium phosphate, dibasic	500	115	9
Calcium phosphate, tribasic	800	304	4
	1600	608	2

Importance of Diet

For good health, it is important that you eat a balanced and varied diet. Follow carefully any diet program your health care professional may recommend. For your specific dietary vitamin and/or mineral needs, ask your health care professional for a list of appropriate foods. If you think that you are not getting enough vitamins and/or minerals in your diet, you may choose to take a dietary supplement. The daily amount of calcium needed is defined in several different ways.

For U.S.—

- Recommended Dietary Allowances (RDAs) are the amount of vitamins and minerals needed to provide for adequate nutrition in most healthy persons. RDAs for a given nutrient may vary depending on a person's age, sex, and physical condition (e.g., pregnancy).
- Daily Values (DVs) are used on food and dietary supplement labels to indicate the percent of the recommended daily amount of each nutrient that a serving provides. DV replaces the previous designation of United States Recommended Daily Allowances (USRDA).

For Canada—

- Recommended Nutrient Intakes (RNIs) are used to determine the amounts of vitamins, minerals, and protein needed to provide adequate nutrition and lessen the risk of chronic disease.

Normal daily recommended intakes in milligrams (mg) for calcium are generally defined as follows:

Persons	U.S. (mg)	Canada (mg)
Infants and children Birth to 3 years of age	400–800	250–550
4 to 6 years of age	800	600
7 to 10 years of age	800	700–1100
Adolescent and adult males	800–1200	800–1100
Adolescent and adult females	800–1200	700–1100
Pregnant females	1200	1200–1500
Breast-feeding females	1200	1200–1500

Getting the proper amount of calcium in the diet every day and participating in weight-bearing exercise (walking, dancing, bicycling, aerobics, jogging), especially during the early years of life (up to about 35 years of age) is most important in helping to build and maintain bones as dense as possible to prevent the development of osteoporosis in later life.

The following table includes some calcium-rich foods. The calcium content of these foods can supply the daily RDA or RNI for calcium if the foods are eaten regularly in sufficient amounts.

Food (amount)	Milligrams of calcium
Nonfat dry milk, reconstituted (1 cup)	375
Lowfat, skim, or whole milk (1 cup)	290 to 300

Yogurt (1 cup)	275 to 400
Sardines with bones (3 ounces)	370
Ricotta cheese, part skim (½ cup)	340
Salmon, canned, with bones (3 ounces)	285
Cheese, Swiss (1 ounce)	272
Cheese, cheddar (1 ounce)	204
Cheese, American (1 ounce)	174
Cottage cheese, lowfat (1 cup)	154
Tofu (4 ounces)	154
Shrimp (1 cup)	147
Ice milk (¾ cup)	132

Vitamin D helps prevent calcium loss from your bones. It is sometimes called "the sunshine vitamin" because it is made in your skin when you are exposed to sunlight. If you get outside in the sunlight every day for 15 to 30 minutes, you should get all the vitamin D you need. However, in northern locations in winter, the sunlight may be too weak to make vitamin D in the skin. Vitamin D may also be obtained from your diet or from multivitamin preparations. Most milk is fortified with vitamin D.

*Do not use bonemeal or dolomite as a source of calcium.* The Food and Drug Administration has issued warnings that bonemeal and dolomite could be dangerous because these products may contain lead.

### Before Using This Medicine

If you are taking this dietary supplement without a prescription, carefully read and follow any precautions on the label. For calcium supplements, the following should be considered:

**Pregnancy**—It is especially important that you are receiving enough calcium when you become pregnant and that you continue to receive the right amount of calcium throughout your pregnancy. The healthy growth and development of the fetus depend on a steady supply of nutrients from the mother. However, taking large amounts of a dietary supplement during pregnancy may be harmful to the mother and/or fetus and should be avoided.

**Breast-feeding**—It is especially important that you receive the right amount of calcium so that your baby will also get the calcium needed to grow properly. However, taking large amounts of a dietary supplement while breast-feeding may be harmful to the mother and/or baby and should be avoided.

**Children**—Problems in children have not been reported with intake of normal daily recommended amounts. Injectable forms of calcium should not be given to children because of the risk of irritating the injection site.

**Older adults**—Problems in older adults have not been reported with intake of normal daily recommended amounts. It is important that older people continue to receive enough calcium in their daily diets. However, some older people may need to take extra calcium or larger doses because they do not absorb calcium as well as younger people. Check with your health care professional if you have any questions about the amount of calcium you should be taking in each day.

### Other medicines—Medicines or other dietary supplements

Although certain medicines or dietary supplements should not be used together at all, in other cases they may be used together even if an interaction might occur. In these cases, your health care professional may want to change the dose, or other precautions may be necessary. When you are taking calcium supplements, it is especially important that your health care professional know if you are taking any of the following:

- Calcium-containing medicines, other—Taking excess calcium may cause too much calcium in the blood or urine and lead to medical problems
- Cellulose sodium phosphate (e.g., Calcibind)—Use with calcium supplements may decrease the effects of cellulose sodium phosphate
- Digitalis glycosides (heart medicine)—Use with calcium supplements by injection may increase the chance of irregular heartbeat
- Etidronate (e.g., Didronel)—Use with calcium supplements may decrease the effects of etidronate; etidronate should not be taken

within 2 hours of calcium supplements

- Gallium nitrate (e.g., Ganite)—Use with calcium supplements may cause gallium nitrate to not work properly
- Magnesium sulfate (for injection)—Use with calcium supplements may cause either medicine to be less effective
- Phenytoin (e.g., Dilantin)—Use with calcium supplements may decrease the effects of both medicines; calcium supplements should not be taken within 1 to 3 hours of phenytoin
- Tetracyclines (medicine for infection) taken by mouth—Use with calcium supplements may decrease the effects of tetracycline; calcium supplements should not be taken within 1 to 3 hours of tetracyclines

**Other medical problems**—The presence of other medical problems may affect the use of calcium supplements. Make sure you tell your health care professional if you have any other medical problems, especially:

- Diarrhea or
- Stomach or intestinal problems—Extra calcium or specific calcium preparations may be necessary in these conditions
- Heart disease—Calcium by injection may increase the chance of irregular heartbeat
- Hypercalcemia (too much calcium in the blood) or
- Hypercalciuria (too much calcium in the urine)—Calcium supplements may make these conditions worse
- Hyperparathyroidism or
- Sarcoidosis—Calcium supplements may increase the chance of hypercalcemia (too much calcium in the blood)
- Hypoparathyroidism—Use of calcium phosphate may cause high blood levels of phosphorus which could increase the chance of side effects
- Kidney disease or stones—Too much calcium may increase the chance of kidney stones

## Proper Use of This Medicine

### Dosing—

The amount of calcium needed to meet normal daily recommended intakes will be different for different individuals. The following information includes only the average amounts of calcium.

- For *oral* dosage form (capsules, chewable tablets, lozenges, oral solution, oral suspension, syrup, tablets, extended-release tablets, tablets for solution):
  - To prevent deficiency, the amount taken by mouth is based on normal daily recommended intakes (Note that the normal daily recommended intakes are expressed as an actual amount of calcium. The salt form [e.g., calcium carbonate, calcium gluconate, etc.] has a different strength):
    - For the U.S.*
      - Adults and teenagers—800 to 1200 milligrams (mg) per day.
      - Pregnant and breast-feeding females—1200 mg per day.
      - Children 4 to 10 years of age—800 mg per day.
      - Children birth to 3 years of age—400 to 800 mg per day.
    - For Canada*
      - Adult and teenage males—800 to 1100 mg per day.
      - Adult and teenage females—700 to 1100 mg per day.
      - Pregnant and breast-feeding females—1200 to 1500 mg per day.
      - Children 7 to 10 years of age—700 to 1100 mg per day.
      - Children 4 to 6 years of age—600 mg per day.
      - Children birth to 3 years of age—250 to 550 mg per day.
  - To treat deficiency:
    - Adults, teenagers, and children—Treatment dose is determined by prescriber for each individual based on



severity of deficiency.

Drink a full glass (8 ounces) of water or juice when taking a calcium supplement. However, if you are taking calcium carbonate as a phosphate binder in kidney dialysis, it is not necessary to drink a glass of water.

*This dietary supplement is best taken 1 to 1½ hours after meals, unless otherwise directed by your health care professional. However, patients with a condition known as achlorhydria may not absorb calcium supplements on an empty stomach and should take them with meals.*

For individuals taking *the chewable tablet form* of this dietary supplement:

- Chew the tablets completely before swallowing.

For individuals taking *the syrup form* of this dietary supplement:

- Take the syrup before meals. This will allow the dietary supplement to work faster.
- Mix in water or fruit juice for infants or children.

Take this dietary supplement only as directed. Do not take more of it and do not take it more often than recommended on the label. To do so may increase the chance of side effects.

#### Missed dose—

If you are taking this dietary supplement on a regular schedule and you miss a dose, take it as soon as possible, then go back to your regular dosing schedule.

#### Storage—

To store this dietary supplement:

- Keep out of the reach of children.
- Store away from heat and direct light.
- Do not store in the bathroom, near the kitchen sink, or in other damp places. Heat or moisture may cause the dietary supplement to break down.
- Keep the liquid form of this dietary supplement from freezing.
- Do not keep outdated dietary supplements or those no longer needed. Be sure that any discarded dietary supplement is out of the reach of children.

### Precautions While Using This Medicine

If this dietary supplement has been ordered for you by your health care professional and you will be taking it in large doses or for a long time, your health care professional should check your progress at regular visits. This is to make sure the calcium is working properly and does not cause unwanted effects.

*Do not take calcium supplements within 1 to 2 hours of taking other medicine by mouth. To do so may keep the other medicine from working properly.*

Unless you are otherwise directed by your health care professional, to make sure that calcium is used properly by your body:

- *Do not take other medicines or dietary supplements containing large amounts of calcium, phosphates, magnesium, or vitamin D unless your health care professional has told you to do so or approved.*
- *Do not take calcium supplements within 1 to 2 hours of eating large amounts of fiber-containing foods, such as bran and whole-grain cereals or breads, especially if you are being treated for hypocalcemia (not enough calcium in your blood).*
- *Do not drink large amounts of alcohol or caffeine-containing beverages (usually more than 8 cups of coffee a day), or use tobacco.*

Some calcium carbonate tablets have been shown to break up too slowly in the stomach to be properly absorbed into the body. If the calcium carbonate tablets you purchase are not specifically labeled as being "USP," check with your pharmacist. He or she may be able to help you determine which tablets are best.

## Side Effects of This Medicine

*Side Effects of This Dietary Supplement* Along with its needed effects, a dietary supplement may cause some unwanted effects. Although the following side effects occur very rarely when the calcium supplement is taken as recommended, they may be more likely to occur if:

- It is taken in large doses.
- It is taken for a long time.
- It is taken by patients with kidney disease.

Check with your health care professional as soon as possible if any of the following side effects occur:

- *More common (for injection form only)*
  - Dizziness; flushing and/or sensation of warmth or heat; irregular heartbeat; nausea or vomiting; skin redness, rash, pain, or burning at injection site; sweating; tingling sensation
- *Rare*
  - Difficult or painful urination; drowsiness ; nausea or vomiting (continuing); weakness
- *Early signs of overdose*
  - Constipation (severe); dryness of mouth ; headache (continuing) ; increased thirst ; irritability ; loss of appetite ; mental depression ; metallic taste ; unusual tiredness or weakness
- *Late signs of overdose*
  - Confusion ; drowsiness (severe) ; high blood pressure ; increased sensitivity of eyes or skin to light ; irregular, fast, or slow heartbeat; unusually large amount of urine or increased frequency of urination

Other side effects not listed above may also occur in some patients. If you notice any other effects, check with your health care professional.

## Additional Information

Once a medicine or dietary supplement has been approved for marketing for a certain use, experience may show that it is also useful for other medical problems. Although this use is not included in product labeling, calcium supplements are used in certain patients with the following medical condition:

- Hyperphosphatemia (too much phosphate in the blood)

Other than the above information, there is no additional information relating to proper use, precautions, or side effects for this use.

Revised: 07/18/1995

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Page last updated: 05 January 2005

## **Appendix F**

- Proposed Rules: Federal Register, Vol. 68, No. 73, Wednesday, April 16, 2003
- Organic Material Review Institute: Comments on USDA, National Organic Program: Proposed Amendments to the National List of Allowed and Prohibited Substances (7CFR Part 205, Docket No. TMD-02-03)

# Proposed Rules

Federal Register

Vol. 68, No. 73

Wednesday, April 16, 2003

This section of the FEDERAL REGISTER contains notices to the public of the proposed issuance of rules and regulations. The purpose of these notices is to give interested persons an opportunity to participate in the rule making prior to the adoption of the final rules.

## DEPARTMENT OF AGRICULTURE

### Agricultural Marketing Service

#### 7 CFR Part 205

[Docket Number TM-02-03]

RIN # 0581-AA40

#### National Organic Program; Proposed Amendments to the National List of Allowed and Prohibited Substances

AGENCY: Agricultural Marketing Service, USDA.

ACTION: Proposed rule.

**SUMMARY:** This proposed rule would amend the U.S. Department of Agriculture's (USDA) National List of Allowed and Prohibited Substances (National List) to reflect recommendations submitted to the Secretary by the National Organic Standards Board (NOSB) from June 6, 2000 through October 20, 2002. Technical corrections have also been included in this proposed rule to clarify specific sections of the National List and adequately reflect previous NOSB recommendations. Consistent with recommendations from the NOSB, this proposed rule would: add ten substances, along with any restrictive annotations, to the National List, revise the annotations of two substances, and make eight technical revisions. In addition to amending the National List, this proposed rule would offer the opportunity for public comment on the use of ethylene in organic crop production.

**DATES:** Comments must be received by April 28, 2003.

**ADDRESSES:** Interested persons may comment on this proposed rule using the following procedures:

- *Mail:* Comments may be submitted by mail to: Richard H. Mathews, Program Manager, National Organic Program, USDA-AMS-TMP-NOP, 1400 Independence Ave., SW., Room 4008-So., Ag Stop 0268, Washington, DC 20250.

- *E-mail:* Comments may be submitted via the internet to:

*National.List@usda.gov.*

- *Fax:* Comments may be submitted by fax to: (202) 205-7808.

- Written comments on this proposed rule should be identified with the docket number TMD-02-03.

Commenters should identify the topic and section number of this proposed rule to which the comment refers.

- Clearly indicate if you are for or against the proposed rule or some portion of it and your reason for it. Include recommended language changes as appropriate.

- Include a copy of articles or other references that support your comments. Only relevant material should be submitted.

It is our intention to have all comments to this proposed rule, whether submitted by mail, E-mail, or fax, available for viewing on the NOP homepage. Comments submitted in response to this proposed rule will be available for viewing in person at USDA-AMS, Transportation and Marketing, Room 4008-South Building, 1400 Independence Ave., SW., Washington, DC, from 9 a.m. to 12 noon and from 1 p.m. to 4 p.m., Monday through Friday (except official Federal holidays). Persons wanting to visit the USDA South Building to view comments received in response to this proposed rule are requested to make an appointment in advance by calling (202) 720-3252.

FOR FURTHER INFORMATION CONTACT: Toni A. Strother, Agricultural Marketing Specialist, Telephone: (202) 720-3252; Fax: (202) 205-7808.

#### SUPPLEMENTARY INFORMATION:

#### I. Background

On December 21, 2000 the Secretary established, within the National Organic Standards (NOS) [7 CFR part 205], the National List (§§ 205.600 through 205.607). The National List is the Federal list that identifies synthetic substances and ingredients that are allowed and nonsynthetic (natural) substances and ingredients that are prohibited for use in organic production and handling. Since established, the National List has not been amended. However, under the authority of the Organic Foods Production Act of 1990 (OFPA), as amended (7 U.S.C. 6501 *et seq.*), the National List can be amended

by the Secretary based on proposed amendments developed by the NOSB.

This proposed rule would amend the National List to reflect recommendations submitted to the Secretary by the NOSB from June 6, 2000 through October 20, 2002. Between the specified time period, the NOSB has recommended that the Secretary add ten substances to §§ 205.601 through 205.603 of the National List based on petitions received from industry participants. These substances were evaluated by the NOSB using the criteria specified in OFPA (7 U.S.C. 6517 and 6518) and the NOS. The NOSB also recommended that the Secretary revise the annotations of two substances included within sections 205.602 and 205.605.

The NOSB has recommended that the Secretary add additional substances to sections 205.603 and 205.605 which have not been included in this proposed rule but are under review and, as appropriate, will be included in future rulemaking.

In addition to the amendments made based on June 6, 2000 through October 20, 2002 NOSB recommendations, this proposed rule would also make technical revisions to specific sections of the National List that provide clarity and adequately reflect the intent of the paragraphs identified within those sections.

#### II. Overview of Proposed Amendments

The following provides an overview of the proposed amendments made to designated sections of the National List: *Section 205.601 Synthetic Substances Allowed for Use in Organic Crop Production*

This proposed rule would amend the introductory paragraph of § 205.601 by adding language which clarifies that synthetic substances used in crop production must be used in a manner which does not contribute to contamination of crops, soil, or water. The proposed amendment further clarifies that synthetic substances, except those in paragraphs (c), (j), (k), and (l), may only be used when the provisions of § 205.206(a) through (d) prove insufficient to prevent or control the target pest.

This proposed rule would amend paragraph (a) of § 205.601 (as algicide, disinfectants and sanitizers, including

irrigation cleaning systems) by adding the following materials:

Copper Sulfate, for use as an algicide, is limited to one application per field during any 24-month period.

Application rates are limited to those which do not increase baseline soil test values for copper over a timeframe agreed upon by the producer and accredited certifying agent.

Ozone Gas, for use as an irrigation system cleaner only; and

Peracetic acid, for use in disinfecting equipment, seed, and asexually propagated planting material.

Paragraph (a) is proposed to be further amended by correcting the spelling of the word "demisters" contained in subparagraph (a)(4) to "demossers."

This proposed rule would amend paragraph (e) of § 205.601 by adding the following material:

Copper Sulfate, for use as tadpole shrimp control in rice production, is limited to one application per field during any 24-month period.

Application rates are limited to levels which do not increase baseline soil test values for copper over a timeframe agreed upon by the producer and accredited certifying agent.

This proposed rule would amend paragraph (i) of § 205.601 (as plant disease control) by adding the following substance:

Peracetic acid, for use to control fire blight bacteria when approved by the Environmental Protection Agency (EPA) under a Special Local Need (24c) registration.

This proposed rule would revise paragraph (k) of § 205.601 (as plant growth regulators) by inserting the word "gas" behind "ethylene" to be consistent with the June 2000 NOSB recommendation for the substance. Section 205.601(k) will now read "As plant growth regulators—Ethylene gas, for regulation of pineapple flowering."

This proposed rule revises paragraph (m) of § 205.601 by inserting a new subpart (2) as follows:

(2) EPA List 3—Inerts of unknown toxicity—for use only in passive pheromone dispensers.

**Section 205.602 Nonsynthetic Substances Prohibited for Use in Organic Crop Production**

This proposed rule would amend § 205.602 by adding the following substance:

Calcium chloride, except as a brine-sourced foliar spray to treat physiological disorders associated with calcium uptake.

This proposed rule revises current paragraph (h) of § 205.602 by amending its annotation to read as follows:

Sodium nitrate—unless use is restricted to no more than 20% of the

crop's total nitrogen requirement; use in spirulina production is unrestricted until October 21, 2005.

**Section 205.603 Synthetic Substances Allowed for Use in Organic Livestock Production**

This proposed rule would revise current subparagraph (4) of § 205.603 (a) by correcting the spelling of the word "chlorohexidine" to "chlorhexidine."

This proposed rule would amend paragraph (d) of § 205.603 (as feed additives) by adding the following substances:

DL—Methionine, DL—Methionine—Hydroxy Analog, and DL—Methionine—Hydroxy Analog Calcium—for use only in organic poultry production until October 21, 2005.

This proposed rule would revise current subparagraph (1) of § 205.603 (d) by removing examples (i) and (ii), copper sulfate and magnesium sulfate, as they are both approved for use by FDA and do not need to be listed individually as examples. As currently published, subparagraphs § 205.603 (d) (1) (i) and (ii) may mislead readers to believe that the use of trace minerals are limited only to copper sulfate and magnesium sulfate. Therefore, the revision made in this proposed rule for current subparagraph (1) of § 205.603 (d) would read "Trace minerals, used for enrichment or fortification when FDA approved."

This proposed rule would amend current paragraph (e) of § 205.603 (As synthetic inert ingredients as classified by the Environmental Protection Agency (EPA), for use with nonsynthetic substances or synthetic substances listed in this section and used as active pesticide ingredients in accordance with any limitations on the use of such substances.) by redesignating current paragraph (f) of § 205.603 as new subparagraph (1) under § 205.603 (e). While drafting § 205.603 for final publication in the *Federal Register*, current paragraph (f) was intended to be designated as § 205.603 (e) (1), however, its designation was not properly assigned. Therefore, this proposed rule redesignates current paragraph (f) of § 205.603 as subparagraph (e) (1) of the same section.

**Section 205.605 Nonagricultural (nonorganic) Substances Allowed as Ingredients in or On Processed Products Labeled as "Organic" or "Made with Organic (specified ingredients or food groups)"**

This proposed rule would amend current paragraph (a) of § 205.605 by adding agar-agar, carageenan and tartaric acid as technical corrections.

These substances were included on the National List proposed in the *Federal Register* on December 16, 1997, but were inadvertently removed from the National List published in the *Federal Register* on March 13, 2000, proposed rule and on December 21, 2000, Final Rule (7 CFR Part 205).

This proposed rule would revise current paragraph (b) (10) of § 205.605 by amending its annotation to read as follows:

Ethylene, allowed for postharvest ripening of tropical fruit and degreening of citrus.

**III. Request for Public Comment on the Use of Ethylene**

Ethylene, for organic crop production, was a substance that was petitioned and reviewed for inclusion onto the National List after promulgation of the proposed rule published in the *Federal Register* on March 13, 2000. The NOSB approved and recommended that ethylene gas be included on the National List with the annotation "for regulation of pineapple flowering." After receiving the NOSB recommendation for the material, the NOP, while finalizing the NOS, included the material on the National List without receiving public comment on the material through the Federal rulemaking process. As a result, this proposed rule requests public comment on the use of ethylene gas for regulation of pineapple flowering.

**IV. Related Documents**

Eight notices were published regarding the meetings of the NOSB and its deliberations on recommendations and substances petitioned for amending the National List. Substances and recommendations included in this proposed rule were announced for NOSB deliberation in the following *Federal Register* Notices: (1) 64 FR 54858, October 8, 1999 (Ethylene); (2) 65 FR 33802, May 25, 2000, (Ethylene gas); (3) 65 FR 64657, October 30, 2000, (Calcium borogluconate and Peracetic acid); (4) 66 FR 19873, February 20, 2001, (Poloxalene); (5) 66 FR 48654, September 21, 2001, (Calcium chloride, Copper sulfate, Methionine); (6) 67 FR 19375, April 19, 2002, (Potassium sorbate and Sodium propionate); (7) 67 FR 54784, August 26, 2002, (Ozone gas, Pheromones, Sodium (Chilean) nitrate, Propylene glycol, Magnesium hydroxide/Magnesium oxide, Kaolin pectin, Bismuth subsalicylate, Flunixin, Xylazine, Tolazoline, Butorphanol, Mineral oil, Activated charcoal, Epinephrine); and (8) 67 FR 62950,

October 9, 2002, (Potassium sulfate and Calcium propionate).

#### V. Statutory and Regulatory Authority

The Organic Foods Production Act of 1990 (OFPA), as amended (7 U.S.C. 6501 *et seq.*), authorizes the Secretary, at section 6517(d)(1), to make amendments to the National List based on proposed amendments developed by the NOSB. Sections 6518(k)(2) and 6518(n) of OFPA authorize the NOSB to develop proposed amendments to the National List for submission to the Secretary and establish a petition process by which persons may petition the NOSB for the purpose of having substances evaluated for inclusion onto or deletion from the National List. The National List petition process is implemented under § 205.607 of the NOS. The current petition process (65 FR 43259) can be accessed through the NOP Web site at <http://www.ams.usda.gov/nop>.

##### A. Executive Order 12866

This action has been determined to be non-significant for purposes of Executive Order 12866, and therefore, does not have to be reviewed by the Office of Management and Budget.

##### B. Executive Order 12988

Executive Order 12988 instructs each executive agency to adhere to certain requirements in the development of new and revised regulations in order to avoid unduly burdening the court system. The final rule was reviewed under this Executive Order and no additional related information has been obtained since then. This proposed rule is not intended to have a retroactive effect.

States and local jurisdictions are preempted under section 2115 of the Organic Foods Production Act (OFPA) (7 U.S.C. 6514) from creating programs of accreditation for private persons or State officials who want to become certifying agents of organic farms or handling operations. A governing State official would have to apply to USDA to be accredited as a certifying agent, as described in section 2115(b) of the OFPA (7 U.S.C. 6514(b)). States are also preempted under sections 2104 through 2108 of the OFPA (7 U.S.C. 6503 through 6507) from creating certification programs to certify organic farms or handling operations unless the State programs have been submitted to, and approved by, the Secretary as meeting the requirements of the OFPA.

Pursuant to section 2108(b)(2) of the OFPA (7 U.S.C. 6507(b)(2)), a State organic certification program may contain additional requirements for the production and handling of organically

produced agricultural products that are produced in the State and for the certification of organic farm and handling operations located within the State under certain circumstances. Such additional requirements must: (a) Further the purposes of the OFPA, (b) not be inconsistent with the OFPA, (c) not be discriminatory toward agricultural commodities organically produced in other States, and (d) not be effective until approved by the Secretary.

Pursuant to section 2120(f) of the OFPA (7 U.S.C. 6519(f)), this regulation would not alter the authority of the Secretary under the Federal Meat Inspection Act (21 U.S.C. 601 *et seq.*), the Poultry Products Inspections Act (21 U.S.C. 451 *et seq.*), or the Egg Products Inspection Act (21 U.S.C. 1031 *et seq.*), concerning meat, poultry, and egg products, nor any of the authorities of the Secretary of Health and Human Services under the Federal Food, Drug and Cosmetic Act (21 U.S.C. 301 *et seq.*), nor the authority of the Administrator of the Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide and Rodenticide Act (7 U.S.C. 136 *et seq.*).

Section 2121 of the OFPA (7 U.S.C. 6520) provides for the Secretary to establish an expedited administrative appeals procedure under which persons may appeal an action of the Secretary, the applicable governing State official, or a certifying agent under this title that adversely affects such person or is inconsistent with the organic certification program established under this title. The OFPA also provides that the U.S. District Court for the district in which a person is located has jurisdiction to review the Secretary's decision.

##### C. Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) (5 U.S.C. 601 *et seq.*) requires agencies to consider the economic impact of each rule on small entities and evaluate alternatives that would accomplish the objectives of the rule without unduly burdening small entities or erecting barriers that would restrict their ability to compete in the market. The purpose is to fit regulatory actions to the scale of businesses subject to the action.

Pursuant to the requirements set forth in the RFA, the Agricultural Marketing Service (AMS) performed an economic impact analysis on small entities in the final rule published in the *Federal Register* on December 21, 2000. AMS has also considered the economic impact of this action on small entities. Due to the changes reflected in this proposed rule that allow the use of

additional substances in agricultural production and handling, the Administrator of AMS certifies that this proposed rule will not have a significant economic impact on a substantial number of small entities. This action relaxes the regulations published in the final rule and provides small entities with more tools to use in day-to-day operations. Small agricultural service firms, which include producers, handlers, and accredited certifying agents, have been defined by the Small Business Administration (SBA) (13 CFR 121.201) as those having annual receipts of less than \$750,000 and small agricultural producers are defined as those having annual receipts of less than \$5,000,000.

The U.S. organic industry at the end of 2001 included nearly 6,600 certified crop and livestock operations, including organic production and handling operations, producers, and handlers. These operations reported certified acreage totaling more than 2.34 million acres, 72,209 certified livestock, and 5.01 million certified poultry. Data on the numbers of certified handling operations are not yet available, but likely number in the thousands, as they would include any operation that transforms raw product into processed products using organic ingredients. Growth in the U.S. organic industry has been significant at all levels. From 1997 to 2001, the total organic acreage grew by 74 percent; livestock numbers certified organic grew by almost 300 percent over the same period, and poultry certified organic increased by 2,118 percent over this time. Sales growth of organic products has been equally significant, growing on average around 20 percent per year. Sales of organic products were approximately \$1 billion in 1993, but are estimated to reach \$13 billion this year, according to the Organic Trade Association (the association that represents the U.S. organic industry). In addition, USDA has accredited 81 certifying agents who have applied to USDA to be accredited in order to provide certification services to producers and handlers. A complete list of names and addresses of accredited certifying agents may be found on the AMS NOP Web site, at <http://www.ams.usda.gov/nop>. AMS believe that most of these entities would be considered small entities under the criteria established by the SBA. Additional regulatory flexibility analysis beyond the regulatory flexibility analysis published in the NOP final rule on December 21, 2000, is not required for the purposes of this proposed rule. Comments from small entities affected by parts of this

proposed rule will be considered in relation to the requirements of the RFA. These comments must be submitted separately and cite 5 U.S.C. 609 in the correspondence.

#### D. Paperwork Reduction Act

Pursuant to the Paperwork Reduction Act of 1995, the existing information collection requirements for the NOP are approved under OMB number 0581-0181. No additional collection or recordkeeping requirements are imposed on the public by this proposed rule. Accordingly, OMB clearance is not required by section 350(h) of the Paperwork Reduction Act, 44 U.S.C. 3501, *et seq.*, or OMB's implementing regulation at 5 CFR part 1320.

#### E. General Notice of Public Rulemaking

This proposed rule reflects recommendations submitted to the Secretary by the NOSB. The ten substances proposed to be added to the National List were based on petitions from the industry and evaluated by the NOSB using criteria in the Act and the regulations. Because these substances are critical to organic production and handling operations, producers and handlers should be able to use them in their operations as soon as possible. Accordingly, AMS believes that a 10-day period for interested persons to comment on this rule is appropriate.

#### List of Subjects in 7 CFR Part 205

Administrative practice and procedure, Agriculture, Animals, Archives and records, Imports, Labeling, Organically produced products, Plants, Reporting and recordkeeping requirements, Seals and insignia, Soil conservation.

For the reasons set forth in the preamble, 7 CFR Part 205, Subpart G is proposed to be amended as follows:

#### PART 205—NATIONAL ORGANIC PROGRAM

1. The authority citation for 7 CFR Part 205 continues to read as follows:

Authority: 7 U.S.C. 6501-6522.

2. Section 205.601 is amended by:
  - a. Revising the introductory text.
  - b. Redesignating paragraphs (a)(3) and (a)(4) as paragraphs (a)(4) and (a)(7), respectively.
  - c. Adding new paragraphs (a)(3), (a)(5), and (a)(6).
  - d. Revising the word "demisters" in newly redesignated paragraph (a)(7) to read "demossers".
  - e. Redesignating paragraphs (e)(3) through (e)(7) as paragraphs (e)(4) through (e)(8).
  - f. Adding a new paragraph (e)(3).

g. Redesignating paragraphs (i)(7) through (i)(10) as paragraphs (i)(8) through (i)(11), respectively.

h. Adding a new paragraph (i)(7).

i. Revising paragraph (k).

j. Adding new paragraph (m)(2).

The revisions read as follows:

#### § 205.601 Synthetic substances allowed for use in organic crop production.

In accordance with restrictions specified in this section, the following synthetic substances may be used in organic crop production: Provided, That, use of such substances do not contribute to contamination of crops, soil, or water. Substances allowed by this section, except those in paragraphs (c), (j), (k), and (l) of this section, may only be used when the provisions set forth in § 205.206(a) through (d) prove insufficient to prevent or control the target pest.

(a) \* \* \*

(3) Copper sulfate—for use as an algicide, is limited to one application per field during any 24-month period. Application rates are limited to those which do not increase baseline soil test values for copper over a timeframe agreed upon by the producer and accredited certifying agent.

\* \* \* \* \*

(5) Ozone gas—for use as an irrigation system cleaner only.

(6) Peracetic acid—for use in disinfecting equipment, seed, and asexually propagated planting material.

\* \* \* \* \*

(e) \* \* \*  
(3) Copper Sulfate—for use as tadpole shrimp control in rice production, is limited to one application per field during any 24-month period. Application rates are limited to levels which do not increase baseline soil test values for copper over a timeframe agreed upon by the producer and accredited certifying agent.

\* \* \* \* \*

(i) \* \* \*  
(7) Peracetic acid—for use to control fire blight bacteria when approved by the Environmental Protection Agency (EPA) under a Special Local Need (24c) registration.

\* \* \* \* \*

(k) As plant growth regulators.  
Ethylene gas—for regulation of pineapple flowering.

\* \* \* \* \*

(m) \* \* \*  
(2) EPA List 3—Inerts of unknown toxicity—for use only in passive pheromone dispensers.

\* \* \* \* \*

3. Section 205.602 is revised to read as follows:

#### § 205.602 Nonsynthetic substances prohibited for use in organic crop production.

The following nonsynthetic substances may not be used in organic crop production:

(a) Ash from manure burning.

(b) Arsenic.

(c) Calcium chloride, brine process is natural and prohibited for use except as a foliar spray to treat a physiological disorder associated with calcium uptake.

(d) Lead salts.

(e) Potassium chloride—unless derived from a mined source and applied in a manner that minimizes chloride accumulation in the soil.

(f) Sodium fluoaluminat (mined).

(g) Sodium nitrate—unless use is restricted to no more than 20% of the crop's total nitrogen requirement, or until October 21, 2005; for unrestricted use in spirulina production.

(h) Strychnine.

(i) Tobacco dust (nicotine sulfate).

(j)–(z) [Reserved]

4. Section 205.603 is amended by:

a. Revising paragraph (a).

b. Revising the word

"chlorohexidine" in paragraph (a)(4) to read "chlorhexidine".

c. Redesignating paragraphs (b)(1) through (b)(5) and (b)(6) as (b)(2) through (b)(6) and (b)(1), respectively.

(d) Redesignating paragraphs (d)(1) and (d)(2) as paragraphs (d)(2) and (d)(3), respectively.

e. Adding a new paragraph (d)(1).

f. Revising newly redesignated paragraph (d)(2).

g. Redesignating paragraph (f) as paragraph (e)(1) and reserving paragraph (e)(2);

h. Reserving paragraphs (f)–(z).

The revisions and addition read as follows:

#### § 205.603 Synthetic substances allowed for use in organic livestock production.

\* \* \* \* \*

(a) As disinfectants, sanitizer, and medical treatments as applicable.

(1) Alcohols.

(i) Ethanol-disinfectant and sanitizer only, prohibited as a feed additive.

(ii) Isopropanol-disinfectant only.

(2) Aspirin—approved for health care use to reduce inflammation.

(3) Biologics—Vaccines.

(4) Chlorhexidine—Allowed for surgical procedures conducted by a veterinarian. Allowed for use as a teat dip when alternative germicidal agents and/or physical barriers have lost their effectiveness.

(5) Chlorine materials—disinfecting and sanitizing facilities and equipment. Residual chlorine levels in the water

shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act.

- (i) Calcium hypochlorite.
- (ii) Chlorine dioxide.
- (iii) Sodium hypochlorite.
- (6) Electrolytes-without antibiotics.
- (7) Glucose.
- (8) Glycerine—Allowed as a livestock teat dip, must be produced through the hydrolysis of fats or oils.
- (9) Hydrogen peroxide.
- (10) Iodine.
- (11) Magnesium sulfate.
- (12) Oxytocin—use in postparturition therapeutic applications.
- (13) Parasiticides, Ivermectin—prohibited in slaughter stock, allowed in emergency treatment for dairy and breeder stock when organic system plan-approved preventive management does not prevent infestation. Milk or milk products from a treated animal cannot be labeled as provided for in subpart D of this part for 90 days following treatment. In breeder stock, treatment cannot occur during the last third of gestation if the progeny will be sold as organic and must not be used during the lactation period of breeding stock.

(14) Phosphoric acid—allowed as an equipment cleaner, *Provided*, That, no direct contact with organically managed livestock or land occurs.

\* \* \* \* \*

(d) \* \* \*

(1) DL—Methionine, DL—Methionine—hydroxy analog, and DL—Methionine—hydroxy analog calcium—for use only in organic poultry production until October 21, 2005.

(2) Trace minerals, used for enrichment or fortification when FDA approved.

\* \* \* \* \*

5. Section 205.605 is revised to read as follows:

**§ 205.605 Nonagricultural (nonorganic) substances allowed as ingredients in or on processed products labeled as "organic" or "made with organic (specified ingredients or food group(s))."**

The following nonagricultural substances may be used as ingredients in or on processed products labeled as "organic" or "made with organic (specified ingredients or food group(s))" only in accordance with any restrictions specified in this section.

(a) *Nonsynthetics allowed:*

Acids (Alginate; Citric—produced by microbial fermentation of carbohydrate substances; and Lactic).

Agar-agar.

Bentonite.

Calcium carbonate.

Calcium chloride.

Carageenan.

Colors, nonsynthetic sources only.

Dairy cultures.

Diatomaceous earth—food filtering aid only.

Enzymes—must be derived from edible, nontoxic plants, nonpathogenic fungi, or nonpathogenic bacteria.

Flavors, nonsynthetic sources only and must not be produced using synthetic solvents and carrier systems or any artificial preservative.

Kaolin.

Magnesium sulfate, nonsynthetic sources only.

Nitrogen—oil-free grades.

Oxygen—oil-free grades.

Perlite—for use only as a filter aid in food processing.

Potassium chloride.

Potassium iodide.

Sodium bicarbonate.

Sodium carbonate.

Tartaric acid.

Waxes—nonsynthetic (Carnauba wax; and Wood resin).

Yeast—nonsynthetic, growth on petrochemical substrate and sulfite waste liquor is prohibited (Autolytate; Bakers; Brewers; Nutritional; and Smoked—nonsynthetic smoke flavoring process must be documented).

(a) *Synthetics allowed:*

Alginates.

Ammonium bicarbonate—for use only as a leavening agent.

Ammonium carbonate—for use only as a leavening agent.

Ascorbic acid.

Calcium citrate.

Calcium hydroxide.

Calcium phosphates (monobasic, dibasic, and tribasic).

Carbon dioxide.

Chlorine materials—disinfecting and sanitizing food contact surfaces, *Except*, That, residual chlorine levels in the water shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act (Calcium hypochlorite; Chlorine dioxide; and Sodium hypochlorite).

Ethylene—allowed for postharvest ripening of tropical fruit and degreening of citrus.

Ferrous sulfate—for iron enrichment or fortification of foods when required by regulation or recommended (independent organization).

Glycerides (mono and di)—for use only in drum drying of food.

Glycerin—produced by hydrolysis of fats and oils.

Hydrogen peroxide.

Lecithin—bleached.

Magnesium carbonate—for use only in agricultural products labeled "made with organic (specified ingredients or food group(s))," prohibited in agricultural products labeled "organic".

Magnesium chloride—derived from sea water.

Magnesium stearate—for use only in agricultural products labeled "made with organic (specified ingredients or food group(s))," prohibited in agricultural products labeled "organic".

Nutrient vitamins and minerals, in accordance with 21 CFR 104.20.

Nutritional Quality Guidelines For Foods.

Ozone.

Pectin (low-methoxy).

Phosphoric acid—cleaning of food-contact surfaces and equipment only.

Potassium acid tartrate.

Potassium tartrate made from tartaric acid.

Potassium carbonate.

Potassium citrate.

Potassium hydroxide—prohibited for use in lye peeling of fruits and vegetables.

Potassium iodide—for use only in agricultural products labeled "made with organic (specified ingredients or food group(s))," prohibited in agricultural products labeled "organic".

Potassium phosphate—for use only in agricultural products labeled "made with organic (specific ingredients or food group(s))," prohibited in agricultural products labeled "organic".

Silicon dioxide.

Sodium citrate.

Sodium hydroxide—prohibited for use in lye peeling of fruits and vegetables.

Sodium phosphates—for use only in dairy foods.

Sulfur dioxide—for use only in wine labeled "made with organic grapes," *Provided*, That, total sulfite concentration does not exceed 100 ppm.

Tocopherols—derived from vegetable oil when rosemary extracts are not a suitable alternative.

Xanthan gum.

[c]-(z) [Reserved]

6. In § 205.607, paragraph (c) is revised to read as follows:

**§ 205.607 Amending the National List.**

\* \* \* \* \*

(c) A petition to amend the National List must be submitted to: Program Manager, USDA/AMS/TMP/NOP, 1400 Independence Ave., SW., Room 4008—So., Ag Stop 0268, Washington, DC 20250.

\* \* \* \* \*

Dated: April 11, 2003.

A.J. Yates,

Administrator, Agricultural Marketing Services.

[FR Doc. 03-9412 Filed 4-15-03; 10:52 am]

BILLING CODE 3410-02-P

## DEPARTMENT OF AGRICULTURE

### Food Safety and Inspection Service

#### 9 CFR Parts 317 and 381

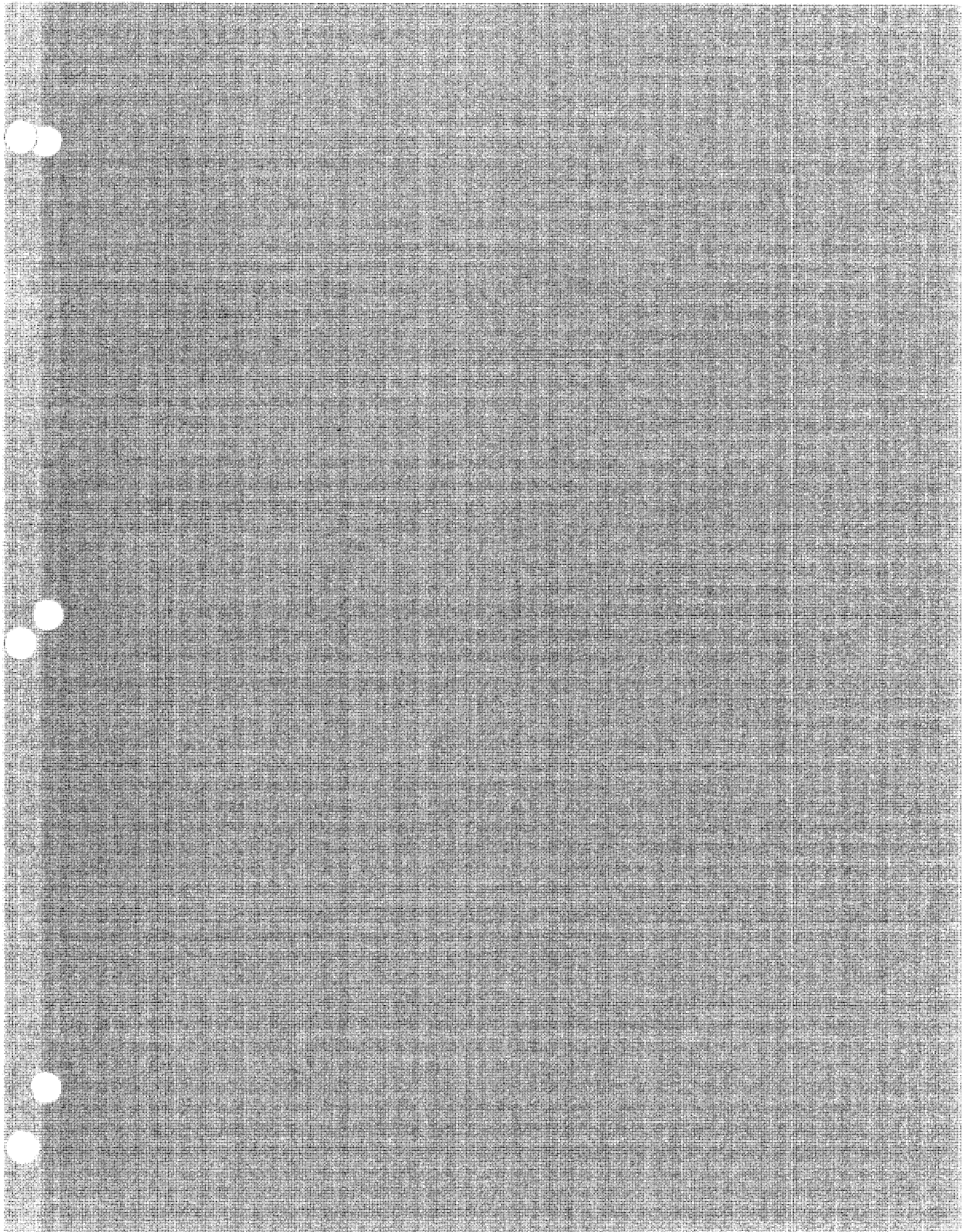
[Docket No. 00-046P]

#### Nutrition Labeling: Nutrient Content Claims on Multi-Serve, Meal-Type Meat and Poultry Products

AGENCY: Food Safety and Inspection Service, USDA.

ACTION: Proposed rule.







Organic Materials Review Institute

Comments on USDA, National Organic Program  
Proposed Amendments to the  
National List of Allowed and Prohibited Substances  
7 CFR Part 205, Docket No. TMD-02-03

April 28, 2003

OMRI appreciates the opportunity to comment on the proposed amendments to the USDA National List of Allowed and Prohibited Substances (National List), Docket Number TMD-02-03. OMRI supports the National Organic Program (NOP) for making technical corrections that were needed in the regulation and for incorporating recommendations of the National Organic Standards Board (NOSB). OMRI offers additional corrections for further improvements to the National List. Our goal is to bring attention to the intent of the public process as set out in the Organic Foods Production Act of 1990 (OFPA), particularly with respect to the advisory function of the NOSB for implementing and amending the National List.

Current NOSB recommendations reflect an extensive evaluation of issues raised in public NOSB meetings, by Technical Advisory Panels (TAP), and through the petition process. The absence of many NOSB recommendations from this Docket imposes delays on the development of a comprehensive National List. OMRI offers its comments both to clarify issues associated with the proposed amendments and to draw attention to the further improvements in the National List that can be implemented by better utilizing the statutory mission of NOSB. The strength of the NOP is in the public partnership that OFPA established between it and the NOSB. OMRI encourages a continued development of that partnership.

***NOSB Recommendations Not Included***

The Docket Background states that between June 6, 2000 and October 20, 2002, the NOSB recommended that the Secretary of Agriculture add ten substances to §§205.601-205.603 based on petitions received from industry participants (68 *Fed. Reg.* 18556). However, by our analysis, the NOSB has recommended 25 substances (See Table 1 of these comments, attached). We would appreciate a regulatory explanation for the absence of NOSB recommendations from the proposed amendments. Additionally, it would be helpful for NOP to issue a public statement as to its plans for addressing the hardships that may occur within the industry as a consequence of this delay in implementing NOSB recommendations. OMRI offers its own comments on these missing substances as follows.

The NOSB identified 13 high-priority livestock medications for expedited TAP reviews (Table 1). OMRI asks why these medications were not included in the proposed amendments, particularly given the urgency with which they were addressed by the NOSB. In October 2002, NOSB also recommended a specific allowance for excipients used in animal drugs to permit formulations of medical products containing approved active ingredients. All of these missing items should be added to the National List out of concern for prudent farm management and animal welfare.

The NOSB recommended 11 processing materials (Table 1) in the period between June 6, 2000 and October 20, 2002. The NOSB also made two recommendations for additions to §205.605 at the November 2000 meeting held in Washington DC, which were not incorporated in the Final Rule published on December 21, 2000. These recommendations included the animal-derived enzymes (rennet, bovine liver catalase, animal lipase, pancreatin, pepsin, trypsin) and peracetic acid. The current Docket added only three processing substances to §205.605 (agar-agar, carageenan, tartaric acid), all of which were based on NOSB recommendations dating to 1995.

NOSB recommendations were developed after lengthy deliberations in public meetings and with public comment. In addition to the abovementioned materials, the NOSB also submitted a list of proposed Technical Corrections in June 2001, which should be considered for future amendments to the National List. It is OMRI's view that adoption of NOSB recommendations should be undertaken in a timely manner. With operators now under the impact of a federally mandated certification system, the lack of an updated National List that incorporates NOSB recommendations poses potential hardships for producers.

### *Comments on §205.601*

We support the revision of the introductory text that refers to relevant restrictions on use of materials as required in §205.203(c) and §205.206 (a-d). OMRI has based its own *Generic Materials List* restrictions (allowed or restricted designation) on these regulatory requirements as well as the specific limitations noted in annotations to the National List. This amended reference will remind producers to review use restrictions both stated in the supporting regulatory text and in the National List itself.

We do question, however, whether all the materials listed in §205.601(a) should be subject to the restrictions in §205.206(a-d). The §205.601(a) category includes algicides, disinfectants, and sanitizers, including irrigation cleaners. While algicides should be subject to the restrictions set out in §205.206 (i.e., preventive methods must be used before synthetic substances are applied), these restrictions should not broadly apply to materials such as alcohols used to clean pruning shears or ozone used to clean irrigation systems. OMRI suggests a revision that would organize the National List category in a more uniform way by moving the heading of "algicides" to §205.601(b) and include it there to read:

§205.601(b) As herbicides, weed barriers, and algicides/demossers, as applicable;

For consistency in the introductory sentence of §205.601, which exempts "(k)" - plant growth regulators, we suggest also including "(f)" - Pheromones, in the exemption from this restriction. Both of these materials, which are registered pesticides with the Environmental Protection Agency (EPA), have been reviewed and specifically added to the National List without restriction, with the recognition that there are few effective alternatives available. For further clarification of the exemptions allowed in §205.601, and consistent with our recommendation for the reassignment of algicides to §205.601(b), we also recommend adding "(a)" to the §205.601 introductory language as follows:

...Substances allowed by this section, except those in paragraphs (a) (c), (f), (j), (k), and (l) of this section, may only be used when the provisions set forth in §205.206(a) through (d) prove insufficient to prevent or control the target pest.

**Pheromones:** The NOSB recommended specific language to amend the annotation for pheromones to correct their inaccurate designation as “insect attractants.” Pheromones are commonly used for insect mating disruption, or mass confusion technique, which is not synonymous with “insect attraction.” In its current form, the proposed amendments deal only indirectly with pheromones by changing the annotation for inert ingredients. Although the proposed addition of List 3 inerts to §205.601(m)(2) for use in passive pheromone dispensers does accomplish the intent of the NOSB recommendation, it does not fully qualify their EPA regulatory status. In addition to asking NOP to reconsider the original NOSB List 3 inert recommendation, OMRI recommends that the proposed NOSB annotation, which was based on EPA recommendations, be adopted as an explanatory policy guidance statement for §205.601(m)(2) to read as follows:

**Pheromones** -includes only EPA-exempt pheromone products, EPA-registered pheromone products with no additional synthetic toxicants unless listed in this section, and any inert ingredients used in such pheromone formulations that are not on EPA List 1 (Inerts of toxicological concern) or EPA List 2 (Potentially toxic inerts), *Provided* the pheromone products are limited to passive dispensers. Pheromone products containing only pheromones, active ingredients listed in this section, and List 4 inerts may be applied without restriction.

The point of this lengthy annotation was to clarify that List 3 inerts can be used in pheromone formulations that are EPA-registered, as well as in those that are exempt from EPA registration, provided that all active ingredients are approved and the pheromone is used in a passive dispenser (trap). According to the current proposed amendment language of §205.601(m)(2), inert ingredients in pheromone formulations may be interpreted to imply their use only in EPA-registered pheromones.

We also suggest that §205.601(f) should be changed to:

“for insect management – Pheromones”

**Hydrated Lime:** The NOSB and OMRI both commented in June 2001 that the annotation in §205.601(i)(3) for hydrated lime is incorrect: “-must be used in a manner that minimizes copper accumulation in the soil.” Hydrated lime was approved for crop use by the NOSB in 1995 in the context of a review of Bordeaux mix (copper sulfate plus hydrated lime). We suggest either deleting the annotation as currently written or revising it to “for use with copper sulfate which must be used in a manner that minimizes copper accumulation in the soil.”

**Peracetic acid:** Although based on a NOSB recommendation, the proposed annotation in §205.601(i)(7), which states “for use to control fire blight bacteria when approved by the EPA under a Special Local Need (24c) registration,” is redundant. Pesticidal use of peracetic is subject to EPA’s regulatory authority. Currently, there are no products registered with EPA for

this use<sup>1</sup>, although they may be developed and registered in the future. This proposed National List language also implies that only products with a Special Local Need (24c) registration may be used for fire blight control. Use for product development research would more likely occur under an Experimental Use Permit, (EPA Section 5 registration) as NOSB noted, thereby encouraging alternatives to antibiotic use for fireblight control.<sup>2</sup> In either case, EPA has regulatory jurisdiction for all pesticidal uses of peracetic acid. Thus, it is not necessary to specify the EPA status in the NOP regulation. We suggest the following correction to §205.601(i)(7):

~~"for use to control fire blight bacteria when approved by the Environmental Protection Agency (EPA) under a Special Local Need (24c) registration."~~

The NOSB also recommended peracetic acid as an approved material for post-harvest handling of crops. In this respect, the broader language of our recommended wording for §205.601(i)(7) is consistent with NOSB recommendations.

### ***Comments on §205.603 – Livestock***

As noted above, the 13 livestock medications approved by NOSB are not included in the proposed amendments although a temporary allowance for the feed additive DL-Methionine is included in §205.603(d)(1). Should the NOSB annotations for extended withdrawal periods for many of these medications be of concern, we would like to note that the current listings in §205.603 for ivermectin, lidocaine, and procaine all contain specific withdrawal time restrictions. We suggest that the NOSB recommendations be addressed consistently with implementation of *all* the NOSB livestock recommendations in these proposed amendments to the National List, with priority given to substances needed to alleviate animal suffering and to provide protection of animal welfare.

### ***Forms of minerals***

OMRI would also like to comment on the revision of the listings for, and the deletion of, **copper sulfate** (21 CFR §582.80) and **magnesium sulfate** (21 CFR §582.5443). Both minerals were the only two for which a TAP review was conducted. NOSB recommended their addition to the National List in November 1995. It also recommended that other minerals as well as synthetic vitamins should be allowed for two years after which TAP reviews would be scheduled (Addendum 18, October 31, 1995). While the December 21, 2000 regulation includes a categorical allowance for "trace minerals, used for enrichment or fortification when FDA approved," NOP has offered no clarification as to the FDA-approved status of minerals. While we agree that FDA has authority over trace minerals for animal feeds under 21 CFR Part 582 and 21 CFR Part 573, NOP's policy is not clear with respect to the determination of approved mineral additives for the National List as authorized under OFPA. This absence of a clear regulatory program is particularly troublesome for minerals not found in 21 CFR and presents questions as to NOP's intended regulatory handling of synthetic minerals for organic production.

<sup>1</sup> <http://www.cdpr.ca.gov/docs/epa/epachem.htm>

<sup>2</sup> TAP review- Peracetic acid, Crops. [http://www.omri.org/peracetic\\_acid.pdf](http://www.omri.org/peracetic_acid.pdf) see p. 7

In the absence of further clarification of approved forms of minerals and vitamins from NOP, OMRI interprets NOP's use of "FDA approved" for livestock use to apply only to those vitamins and minerals listed in 21 CFR Parts 582 and 573. As suggested in our comments dated January 24, 2002, OMRI believes that additional TAP reviews are needed to clarify which synthetic forms of vitamins and minerals are permitted, which forms are necessary, and which forms are compliant with OFPA for use in organic production.

In 1995, the NOSB clearly stated its policy that nutrients should first and mostly come from organically produced agricultural sources, non-synthetic vitamins and minerals should be used when available, and synthetically produced vitamins and minerals should be used only if natural sources are unavailable. This policy was reaffirmed in the April 11, 2002 NOSB Livestock Committee proposal:

"The NOSB continues to support an allowance for specific synthetic vitamins and minerals as warranted by the conditions and circumstances specified in an approved organic system plan. Synthetic supplements should not be used as a substitute for a balanced feed ration including access to pasture for ruminants and exposure to direct sunlight for all livestock.

Furthermore, Section 2115(c)(1)(B)(ii) of the Organic Foods Production Act (OFPA) requires that a synthetic substance only be allowed when a wholly natural substitute product is not available. The importance of organically produced agricultural products and direct sunlight in organic livestock production and the availability of many natural sources of vitamins and minerals dictate that the allowance for synthetic forms of these nutrients should be carefully proscribed. At this time, the NOSB recommends that the allowance for synthetic vitamins and minerals contained in Sections 205.603(d)(1) and (2) include materials either listed for such use in the CFR or in Sections 57 or 90 of the AAFCO Official Publication...."

The NOSB final recommendation from May 8, 2002 also states:

"The NOSB recognizes the need to review the following materials and recommends a TAP review to determine if the following materials should be prohibited:

Ammonium sulfate, ethylenediamine dihydriodide (*sic*), metal amino acid complex, mete (*sic*) (specific amino acid) complex, metal amino acid chelate, metal proteniate (*sic*), ammonium polyphosphate solution, diammonium phosphate, monoammonium phosphate, zinc chloride diammine (*sic*) complex, and menadione forms."

Materials in this recommended TAP review list contain synthetic nitrogen or sulfites that are prohibited in organic feed or handling by OFPA. On the advice of its Advisory Council of scientific and technical experts, OMRI considers these materials to be prohibited until TAP reviews find otherwise and provide justification for their addition to the National List. OMRI recommends maintaining copper sulfate and magnesium sulfate on the National List until the TAP reviews for other synthetic vitamins and minerals are completed and clarification of appropriate forms of vitamins and minerals is made.

With respect to the current proposed amendment language, OMRI recommends deleting the term "trace" because magnesium is considered a macro-element in animal nutrition by the National Academy of Sciences, as are calcium, phosphorous, sodium, potassium, sulfur and chlorine.

OMRI would also like to note that the May 2002 NOSB recommendations on other feed additives have not been adopted by NOP in these proposed amendments.

***Additional comments on §205.603 – Livestock***

OMRI appreciates the deletion of the **inert ingredients** language from §205.603(f) and its move to (e)(1). This is an important clarification that EPA List 4 inert ingredients are permitted only in pesticides approved for organic livestock use.

In November 2000, NOSB recommended a change in the annotation for **ivermectin** to add: “slow release formulations such as the SR (slow release) bolus are prohibited.” OMRI again brings this important recommendation to the attention of NOP and requests that the NOSB language be added to the annotation in §205.603(a)(13).

The question of **excipients** should also be addressed. OMRI supports the October 2002 NOSB recommendation for a suggested language change in §205.603(a) to read as follows:

§205.603(a) excipients, for use in livestock drugs, except:  
(i) reserved [any specific substances that may be prohibited]

Another correction is still needed in §205.603(b)(3) **Lime, hydrated**. The regulation continues to state “(bordeaux mixes), not permitted to cauterize physical alterations or deodorize animal wastes.” OMRI and the NOSB have both commented that the regulatory use of “Bordeaux mix” here is incorrect. Bordeaux mix is a crop protection material, not a livestock material. We suggest the following language change:

§205.603(b)(3): lime, hydrated, ~~(bordeaux mixes)~~, as external pest control, not permitted to cauterize physical alterations or deodorize animal wastes.

***Comments on §205.605***

As OMRI and NOSB have commented previously in requests for technical corrections, the NOSB did not review **natural colors** for use in organic food processing. We urge the Secretary to immediately remove “colors, non-synthetic” from §205.605 because any further delay or confusion in addressing this issue will be increasingly costly to remedy. The National List is not clear as to which coloring agents this section refers, nor does FDA, in its regulatory authority over colors used in processed foods, have a standard of identity for “natural colors.”

OMRI notes the addition of **agar-agar**, **carageenan**, and **tartaric acid** to the National List as recommended by the NOSB in 1995. Since tartaric acid was approved by NOSB from both synthetic (made from malic acid) and nonsynthetic sources (made from grapes), OMRI recommends that it also be added to §205.605(b) to allow use of its synthetic form.

We would like to draw attention to processing materials recently recommended by NOSB but omitted from the proposed amendments. **Calcium sulfate** and **glucono delta-lactone** were both approved, in 2001 and 2002 respectively, and are widely used as the preferred coagulants for certain styles of organic tofu. These two materials were reviewed carefully, a clear need was demonstrated, and NOSB determined that they are clearly functional food additives that meet



statutory and regulatory criteria for processing. We respectfully request that NOP reconsider the NOSB recommendations for calcium sulfate and glucono delta-lactone.

Another unexplained omission of a NOSB processing recommendation deals with **potassium hydroxide**. The proposed amendments leave standing the current annotation in §205.605(b). In 2001, the NOSB approved an additional use of this substance for peeling peaches used in the individual quick freezing process. The un-amended annotation prohibits potassium hydroxide for this special use, contrary to the expectations of the organic industry, and jeopardizes the certification and labeling of these products.

Please note a typographical error: §205.605(a) Synthetics allowed – should be numbered as §205.605(b) Synthetics allowed.

### ***Comments on §205.606***

**Gelatin** and **orange shellac** were both recommended by the NOSB to be added to §205.606, yet neither appear in this docket. The NOSB described these two materials as agricultural ingredients that are subject to the commercial availability clause in this section. The NOP's decision making to not include these two substances in the proposed amendments should be explained. As nonorganically produced agricultural products, gelatin and orange shellac cannot be used at present, despite the lengthy petition and review process that found them both suitable for organic production. Given the extensive evaluation supporting the NOSB recommendations, these two substances should be placed on the National List.

### ***Conclusion***

OMRI commends the NOP on its efforts in administering the National List and in initiating the implementation of the regulatory program supervising organic production. A great deal of progress has been made by the NOP and NOSB in building a viable, workable National List from a complex set of materials issues relating to a wide spectrum of agricultural commodities that includes field, vegetable and livestock crops as well as processed food. The industry is aware of the limited resources currently available to the NOP in conducting its statutory mission. As an industry service arm developed to handle materials review, OMRI offers its expertise to assist in any way possible to help craft a strong and functional National List that reflects the consensus of the organic community and serves the goals of preserving and improving organic integrity. We look forward to the finalization of this Docket, and future amendments that we trust will include the adoption of all of the NOSB recommendations.

Respectfully submitted,

Dr. Laura Morrison  
Executive Director  
Organic Materials Review Institute  
P.O. Box 11558  
Eugene, Oregon 97440

Table 1

National List Recommendations Made by National Organic Standards Board from April 1995- October 2002, Compared to the Federal Register Docket TM-02-03

Substances included in Federal Register

Material	NOSB Recommended category	NOSB Date of vote	NOSB recommendation and annotation	NOP Docket language 68 Fed Reg 18556, April 16, 2003 7 CFR 205 (additions and changes to December 21, 2000 Rule)
<b>CROPS</b>				
1,4 dimethyl-naphthalene		10-20-02	Prohibited synthetic (reviewed as sprout inhibitor)	Not added
calcium chloride, (from brine process)	205.602	10-01	Nonsynthetic, prohibited, except as a foliar spray to treat a physiological disorder associated with calcium uptake	205.602(c) Calcium chloride, brine process is natural and is prohibited for use except as a foliar spray to treat a physiological disorder associated with calcium uptake.
calcium oxide		5-07-02	Prohibited (considered for fertilizer use)	Not added
calcium hydroxide		5-07-02	Prohibited (considered for fertilizer use)	Not added
copper sulfate	205.601	10-01	Synthetic. Amend annotation to add: allowed only with documented need for algicide and tadpole shrimp control in aquatic rice systems, not to exceed one application per 2-year interval; used in a manner to minimize accumulation of copper in the soil and water systems.	205.601(a)(3) Copper sulfate--for use as an algicide, is limited to one application per field during any 24-month period. Application rates are limited to those which do not increase baseline soil test values for copper over a timeframe agreed upon by the producer and accredited certifying agent.  205.601(e)(3)--Copper sulfate for use as tadpole shrimp control in rice production, is limited to one application per field during any 24-month period. Application rates are limited to levels which do not increase baseline soil test values for copper

Comments on NOP Proposed Amendments to the National List, Docket No. TMD-02-03

Material	NOSB Recommended category	NOSB Date of vote	NOSB recommendation and annotation	NOP Docket language 68 Fed Reg 18536, April 16, 2003 7 CFR 205 (additions and changes to December 21, 2000 Rule) over a timeframe agreed upon by the producer and accredited certifying agent.
ethylene gas	205.601	06-06-2000	synthetic, allowed for regulation of pineapple flowering. see pheromones	205.601(k) ethylene gas—for regulation of pineapple flowering. 205.601(m)(2) EPA List 3—Inerts of unknown toxicity—for use only in passive pheromone dispensers.
Inert ingredients of unknown toxicity				
Oils, narrow range (petroleum distillates)		11-01-95	Allowed as suffocating or stylet oils on foliage and as inert ingredients.	Not added as inert ingredients.
ozone	205.601	9-18-02	Allowed with the annotation: <u>To clean irrigation lines only</u>	205.601(a)(5) ozone gas—for use as an irrigation system cleaner only.
peracetic acid	205.601	9-00	Synthetic. Allowed to disinfect equipment. Allowed to disinfect seed and asexually propagated planting material (i.e., bulb, corm, tubers) used for planting crops. Allowed for firelight control only with an Experimental Use Permit with documentation that alternatives including biocontrols have been tried.	205.601(a)(6) peracetic acid—for use in disinfecting equipment, seed, and asexually propagated planting material. 205.601(i) (7) peracetic acid—for use to control fire blight bacteria when approved by the Environmental Protection Agency (EPA) under a Special Local Need (24c) registration.
pheromones (TAP was done for Butylated hydroxy-toluene (BHT))	205.601(f)	10-20-02	Allowed, changed annotation as follows: As-insect-attractants— Pheromones -includes only EPA exempt pheromone products, EPA registered pheromone products with no additional toxicants unless listed in this section, and any inert ingredients used in such pheromone formulations that are not on EPA List 1 (Inerts of toxicological concern) or EPA List 2 (Potentially toxic inerts), <i>Provided</i> the pheromone products are limited to passive dispensers. Pheromone products containing only	No change, see Inert ingredients 205.601 (f) As insect attractants - pheromones

Comments on NOP Proposed Amendments to the National List, Docket No. TMD-02-03

Material	NOSB Recommended category	NOSB Date of vote	NOSB recommendation and annotation	NOP Docket language 68 Fed Reg 18536, April 16, 2003 7 CFR 205 (additions and changes to December 21, 2000 Rule)
potassium sorbate			pheromones, active ingredients listed in this section, and List 4 inerts may be applied without restriction.	
potassium sulfate		5-7-02 10-20-02	Prohibited, considered for seed treatment	Not added.
sodium chloride	205.602	9-96	Prohibited from synthetic sources (nonsynthetic mined sources remain allowed)	Not added.
sodium nitrate	205.602(h)	9-19-02	Nonsynthetic, prohibited, except for use in cotton production to comply with emergency spray programs or to prevent immediate loss of crop. Non-synthetic and prohibited; annotation changed: unless use is restricted to no more than 20% of the crop's total nitrogen requirement; OR for unrestricted use in <i>Spirulina</i> production until October 21st, 2005.	Not added. 205.602(g) Sodium nitrate—unless use is restricted to no more than 20% of the crop's total nitrogen requirement, or until October 21, 2005; for unrestricted use in <i>spirulina</i> production.
sodium propionate		5-07-02	Prohibited, considered for seed treatment	Not added.
spinosad	Nonsynthetic	5-07-02	Nonsynthetic, allowed (will not appear on National List)	Not added.
<b>Livestock</b>				
activated carbon	205.603(a)	9-18-02	Allowed from vegetative sources only.	Not added.
bismuth subsalicylate	205.603(a)	9-18-02	Allowed.	Not added.
butorphanol	205.603(a)	9-18-02	Allowed with the annotations: withhold time shall be double the FDA requirement	Not added.
calcium borogluconate	205.603(a)	11-00	Allowed for milk fever	Not added.
calcium propionate	205.603(a)	9-18-02	Allowed with the annotation: for treatment of milk fever only.	Not added.
cell wall carbohydrates	Nonsynthetic	9-18-02	Allowed [Not added to the National List]	Not added.
chlorhexidine	205.603(a)	9-96	Allowed	205.603(a)(4)—Allowed for surgical procedures conducted by a veterinarian. Allowed for use as a teat dip when alternative germicidal agents and/or physical barriers have lost

Comments on NOP Proposed Amendments to the National List, Docket No. TMD-02-03

Material	NOSB Recommended category	NOSB Date of vote	NOSB recommendation and annotation	NOP Docket language
DL-methionine	205.603(d)	10-01	Allowed with annotation: <u>for interim use by the organic poultry industry until October 21, 2005.</u>	68 Fed Reg 18556, April 16, 2003 7 CFR 205 (additions and changes to December 21, 2000 Rule) their effectiveness.
epinephrine/ adrenaline	205.604	9-18-02	[prohibited nonsynthetic] except for emergency treatment of anaphylactic shock.	205.603(d) DL-Methionine, DL- Methionine--hydroxy analog, and DL- Methionine--hydroxy analog calcium for use only in organic poultry production until October 21, 2005.
flunixin	§205.603(a):	10-20-02	Allowed with the annotation: <u>withhold time shall be double the FDA requirement</u>	Not added.
glycerine glycerin		9-99		Not added.
heparin		9-19-02	Prohibited	205.603(a)(8) Glycerine-Allowed as a livestock test dip, must be produced through the hydrolysis of fats or oils.
ivermectin	205.603(a)(12)	11-00	Amend annotation to add: <u>slow release formulations such as the SR (slow release) bolus are prohibited.</u>	Not added. Not added. Renumbered as 205.603(a) (13)
kaolin pectin	205.603(a):	9-18-02	Allowed [for healthcare]	Not added.
magnesium oxide / magnesium hydroxide	205.603(a)	9-18-02	Allowed [for healthcare]	Not added.
mineral oil	205.603(a)	9-18-02	Allowed for healthcare.	Not added to 205.603(a) for internal use. Renumbers 205.603(b)(4) to 205.603(b)(5), remains only for topical (external) use
peracetic acid	205.603(a)	11-00	Allowed with annotation: <u>For facility and processing equipment sanitation (barns, milking parlors, pipelines, processing areas)</u>	Not added to 205.603 for livestock use.
pheromones -- livestock	205.603	10-20-02	Allowed [Same annotation as for crops]	Not added.
poloxalone	Livestock	03-01	Synthetic. Allowed for emergency treatment of	Not added.

Comments on NOP Proposed Amendments to the National List, Docket No. TMD-02-03

Material	NOSB Recommended category	NOSB Date of vote	NOSB recommendation and annotation	NOP Docket language 68 Fed Reg 18556, April 16, 2003 7 CFR 205 (additions and changes to December 21, 2000 Rule)
	205.603(a)		<u>bleat.</u>	
potassium sorbate	205.603(a), (b), (d)?	9-18-02	Allowed with the annotation: <u>only for use in aloe vera products for livestock production</u>	Not added.
propylene glycol	205.603(a)	9-19-02	Allowed with the annotation: <u>only for treatment of acute ketosis.</u>	Not added.
tolazoline	205.603(a)	9-19-02	Allowed with the annotation: <u>For emergency use only, as antidote to xylazine, withhold time shall be double FDA requirements.</u>	Not added.
trace minerals	205.603(d)	10-31-95	Synthetic, allowed until reviewed.	205.603(d) Trace minerals, used for enrichment or fortification when FDA approved, including: (f) Copper sulfate, (ff) Magnesium sulfate.
xylazine	205.603(a)	9-19-02	Allowed with the annotation: <u>for emergency use only, withhold time shall be double FDA requirements.</u>	Not added.
yeast derivatives	Nonsynthetic	9-19-02	Allowed. [Not added to the National List]	Not added.
<b>Processing</b> agar-agar	205.605(a)	4-95	Non-synthetic, allowed.	205.605(a) Agar-agar.
activated carbon	205.605(b)	9-19-02	Allowed with the annotation: <u>from vegetative sources only for use as filtering aid</u>	Not added.
ammonium hydroxide	205.605(b)	10-01	Synthetic, allowed. <u>For use as a boiler additive only until Oct. 21, 2005</u>	Not added.
calcium sulfate	205.605(a)	05-01	Nonsynthetic. <u>Allowed from nonsynthetic sources only.</u>	Not added.
calcium stearate		9-19-02	Prohibited for organic and made with organic	Not added.
carageenan	205.605(a)	04-95	Non-synthetic, allowed.	205.605(a) Carageenan.
cellulose	205.605(b)	10-01	Synthetic, allowed. <u>For use in regenerative casings, as anti-caking agent (non-chlorine bleached) and filtering aid.</u>	Not added.
cyclohexylamine	205.605(b)	10-01	Synthetic, allowed. <u>For use only as boiler water additive for packaging sterilization only.</u>	Not added.

Comments on NOP Proposed Amendments to the National List, Docket No. TMD-02-03

Material	NOSB Recommended category	NOSB Date of vote	NOSB recommendation and annotation	NOP Docket language 68 Fed Reg 18556, April 16, 2003 7 CFR 205 (additions and changes to December 21, 2000 Rule)
diethylamino-ethanol	205.605(b)	05-07-02	Synthetic, allowed. For use only as boiler water additive for packaging sterilization only.	Not added.
enzymes, animal derived	205.605(a)	11-00	Nonsynthetic, allowed. Rennet (animal derived); catalase (bovine liver); animal lipase; pancreatin; pepsin; trypsin.	Animal sources not added.
ethylene	205.605(b)	11-01	Synthetic, annotation amended. For post harvest ripening of tropical fruit and degreening of citrus	205.605(a) Ethylene--allowed for post harvest ripening of tropical fruit and degreening of citrus. [section-numbering error: the "(a) Synthetics allowed;" should be "(b) Synthetics allowed."]
gelatin	205.606	05-07-02	Approved as agricultural, must be from organic source when commercially available	Not added.
glycerol monooleate		9-19-02	Synthetic, Prohibited (petition withdrawn)	Not added.
glucono delta-lactone	205.605(a)	9-19-02	Nonsynthetic, Allowed with the annotation: produced through microbial fermentation of carbohydrates only.	Not added.
hydroxypropyl methylcellulose (HPMC)		9-19-02	Prohibited, for use in Made with Organic category and Organic	Not added.
octadecylamine	205.605 (b)	10-01	Synthetic, allowed. For use only as boiler water additive for packaging sterilization only.	Not added.
peracetic acid	205.605(b)	11-00	Synthetic, allowed. For direct food contact only in wash and/or rinse water. Allowed as sanitizer on surfaces in contact with organic food.	Not added.
potassium hydroxide	205.605(b)(27)	10-01	Synthetic, allowed. Amend annotation to read: Prohibited for lye peeling of fruits and vegetables except when used for peeling peaches during the individually quick frozen production process.	Not changed. Annotation still reads: Prohibited for use in lye peeling of fruits and vegetables.
shellac, orange, unbleached	205.606	05-07-02	Approved as agricultural, must be organic when available	Not added.

Comments on NOP Proposed Amendments to the National List, Docket No. TMD-02-03

Material	NOSB Recommended category	NOSB Date of vote	NOSB recommendation and annotation	NOP Docket language
tartaric acid	205.605(a-b)	11-95	Nonsynthetic (made from grapes), Allowed. Synthetic, made from malic acid, Allowed.	68 Fed Reg 18556, April 16, 2003 7 CFR 205 (additions and changes to December 21, 2000 Rule) 205.601(a) <u>Tartaric acid</u> . [natural source only; synthetic form not added]
tetrasodium pyrophosphate	205.603(b)	9-19-02	Allowed with the annotation: <u>for use only in textured meat analog products</u>	Not added.



## **Appendix G**

- Mishra: *Calcium Chloride and Potassium Chloride in Soil Application: A Comparative Analysis*
- Mishra: *Salt Affected Soil: Problems and Solutions*
- Ruehr: *Informative Report to National Organic Standard Board (August 10, 2004)*
- References Related to Calcium and Chloride as Plant Nutrients

**Calcium Chloride and Potassium Chloride in Soil Application:**  
**A Comparative Analysis**

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***Introduction:***

Average concentrations of potassium (K) and calcium (Ca) in plants are about 1.0% and 0.5%, respectively (Trisdale et al, 1993). K is a primary nutrient. Its application rate to crops is much greater than Ca. Potassium chloride (KCl) is a common source of K for the crops. Chloride content in the KCl molecule is 47.62%, as compared to the chloride content of CaCl<sub>2</sub> molecule being 64.93%.

The addition of KCl to soil to replenish the K nutrient that is taken up by the crops is a much greater amount than CaCl<sub>2</sub> needed as the calcium source. Rate of 1,000 lb./acre of KCl application to soil is not uncommon. CaCl<sub>2</sub> application rate, on the other hand, is mostly less than 350 lb./acre. Consequently, the chloride contribution to soil from the application of KCl is about 3 times greater than that of CaCl<sub>2</sub>.

Calcium chloride is an excellent source of Ca and Cl nutrients for crops.

***How is Chloride a Problem?***

CaCl<sub>2</sub> has been approved by the National Organic Standard Board (NOSB) only for foliar applications in organic farming [*The National List of Allowed and Prohibited Substances, Section 205.602 (c)*]. However, for soil applications, only KCl is allowed to be used with the proviso that it should be used only in the manner that will minimize chloride accumulation in the soil [*The National List of Allowed and Prohibited Substances, Section 205.602 (e)*]. The concern is genuine, as excessive amount of chloride in soil can be toxic to many crops. With potassium being a monovalent cation, its accumulation can disperse soil particles resulting in reduced permeability of the soil structure. The dispersive effect of K<sup>+</sup> ions on soil is well established (Rungasamy and Marchuk, 2011). Basic colloid studies by Hunter (1993) showed an almost exact correspondence between the effect of sodium and potassium in aqueous suspensions.

Chloride anions do not adsorb at the negatively charged soil particle surfaces. In the dispersed condition of soil, chloride, in fact, is mechanically entrapped in the soil cross section. Under such condition, irrigation water is unable to reach and wash chloride out of the root zone. Through gradual accumulation in the soil structure in this manner, chloride ions can reach the toxic level for crops. - The concern from the NOSB for chloride in KCl is valid.

Unlike the monovalent K<sup>+</sup> ion of KCl, the divalent Ca<sup>2+</sup> cation of CaCl<sub>2</sub> being stronger, as shown in the Lyotropic Series (1), flocculates the soil structure and makes it more water permeable.

*Lyotropic Series:* The Lyotropic Series is based on the valency and the hydrated diameter of the ions, stated here in nanometer (nm) = 0.1 angstrom (A), which is as follows:



When  $\text{CaCl}_2$  is used in soil application, chloride ions do not get entrapped in the soil structure. It moves down with the irrigation water in the soil cross section. This minimizes the danger of accumulating chloride in soil to a toxic level. The concern that chloride ions accumulate in the crop root zone is alleviated in the case of  $\text{CaCl}_2$ .

It becomes obvious that, if chloride accumulation in the soil structure is a major concern, it is safer to use  $\text{CaCl}_2$  than KCl. Apart from this, by improving the drainage characteristics of the soil and consequently improving the air uptake of the soil structure, for the microorganism's habitat of the soil,  $\text{CaCl}_2$  is the preferred additive over KCl.

#### ***Calcium Chloride in Soil Amendment:***

In a recent announcement (Oct. 28, 2014), UN University's Canada based Institute of Water, Environment and Health (UNU-INWEH), reported that globally, an estimated 20 percent of irrigated lands (about 775 million acres) are salt ( $\text{NaCl}$ ) affected. While this damage to the soil is wide spread in Northern America, it is estimated that in California alone half of irrigated croplands are affected (UC AICS, 2009).

Chemical amendment is the most effective method of overcoming the problems associated with the salt affected soil. In the salt affected soil, sodium ion ( $\text{Na}^+$ ) adsorption disperses soil particles, resulting in their compaction. In turn, it minimizes water penetration, depriving the crop root zone of moisture and oxygen. Apart from this, most of the crops are sensitive to high levels of sodium. It is, therefore, critical that through ion exchange the adsorbed  $\text{Na}^+$  ion is replaced with stronger cations.  $\text{Ca}^{2+}$  ion has been established to be the most effective cation. Therefore, calcium electrolytes are commonly used in the remediation of salt affected soil.

There are some non-chloride calcium products, such as chelates of calcium with amino acids or humic acids, which can be used in the remediation of salt affected soil. However, they are expensive source of calcium for the remediation purpose. Calcium chloride is the preferred chemical for this application.

*Improved Water Drainage of Soil Cross Section:* With the application of calcium chloride,  $\text{Ca}^{2+}$  ions replace the adsorbed  $\text{Na}^+$  ions at the particle surface through the ion exchange process. Adsorption of  $\text{Ca}^{2+}$  ions flocculates the dispersed particles, improving the drainage characteristics of the soil cross section, resulting in greater water permeation through the soil. The  $\text{Cl}^-$  ions from the introduced calcium chloride, being free ions also drain along with the  $\text{Na}^+$  and  $\text{Cl}^-$  ions of the soil system.

With adequate treatment, and time, all these free ions are taken away from the root zone. In fact, the addition of calcium chloride does not increase the chloride content of the soil. Contrary to this, it helps in the removal of otherwise entrapped chloride of the soil. As the adsorption of  $\text{Ca}^{2+}$  ions is due to electrostatic (Coulombic) forces, the replacement of  $\text{Na}^+$  in the soil cross section is rapid, as observed by Mishra et al (1999) in the remediation of salt affected agriculture land in an oilfield.

*Fate of Chloride in Soil Cross Section:* Anionic  $\text{Cl}^-$  neither adsorbs at the like charged soil mineral particles, nor associates with the organic matters of the soil. They are repelled by the negatively charged soil particles; and they move with the irrigation water. If the soil is adequately draining,  $\text{Cl}^-$  ions move out of the root zone. However, in the dispersed and compacted soil the  $\text{Cl}^-$  ions are physically entrapped. The fact that the salt affected soil invariably contains high chloride content is attributed to the effect of  $\text{Na}^+$  adsorption at soil particles which disperses and consequently promotes compaction of the soil.

This dispersed and compacted soil impedes the drainage of water in the soil cross section, and keeps the chloride ions physically entrapped. In this soil cross section, once the negatively charged surfaces of particles are neutralized by positively charged  $\text{Na}^+$  ions, the remaining free  $\text{Na}^+$  ions along with the  $\text{Cl}^-$  ions, are physically trapped in the resulting dispersed and compacted soil. These remaining  $\text{Na}^+$  ions and  $\text{Cl}^-$  ions can be removed from the soil cross section if the dispersed particles are destabilized.

*Additional Benefits of Calcium Chloride in Soil Application:* The application of calcium chloride not only remediates salt affected soil it also improves the uptake of nitrogen nutrient. Fenn (1985) and Feagley and Fenn (1998) have shown that the application of calcium chloride to the soil reduces the ammonia volatilization from the nitrogen fertilizers, particularly urea. Growers are blending calcium chloride with urea or UAN 32, or ammonium nitrate with improved nitrogen uptake, resulting in greater yields of various crops.

Calcium chloride has also shown to impede environmentally undesirable leaching of soluble phosphorus when applied to the soil fertilized with animal manures (Yang, et al, 2007). Value of calcium and chloride as crop nutrients is given through the listing of pertinent references listed separately at the end of this article.

#### ***Calcium Chloride in Organic Crops:***

As calcium chloride is effective in the amendment of salt affected soil, it is used in the production of different crops, including fruits and vegetables. The product is widely used as an anti-crusting agent for improved germination of seeds, to improve water drainage, and as calcium and chloride nutrients for crops. With the increasing interest in organic farming, the growers are asking for the commercial product Hi-Cal liquid calcium chloride that is OMRI (Organic Materials Review Institute) certified for soil application. They are familiar with the product; and also use TETRA's OMRI certified Hi-Cal for foliar applications.

#### ***Commercial Production of $\text{CaCl}_2$ and $\text{KCl}$***

Both,  $\text{CaCl}_2$  and  $\text{KCl}$ , have mineral origin. They are either naturally found in the form of brine that needs to be processed to separate these compounds from the undesirable materials, or are manufactured from naturally occurring minerals.

Naturally occurring brine may contain  $\text{CaCl}_2$ ,  $\text{MgCl}_2$ ,  $\text{KCl}$  and  $\text{NaCl}$  in different concentrations. With these salts having different solubility in water, they can be separated by the well established technique of fractional crystallization. *Calcium chloride from the Mojave Desert of California is produced by TETRA Technologies, Inc. by this process, as given.* Potassium chloride of sylvinite, a mixture of rock salt ( $\text{NaCl}$ ) and sylvite ( $\text{KCl}$ ), is also separated from sodium chloride, a component of this mineral by the same fractional crystallization process.

CaCl<sub>2</sub> is also produced from naturally occurring limestone by reacting it with hydrochloric acid. On the other hand, minerals such as carnallite (KCl.MgCl<sub>2</sub>.6H<sub>2</sub>O), kainite (KCl. MgSO<sub>4</sub>. 3H<sub>2</sub>O) and hartsalz (a mixture of carnallite, sylvite and kieserite, MgSO<sub>4</sub>.H<sub>2</sub>O) are the raw materials that are used in the manufacturing of potassium chloride

### ***Concluding Remarks***

- Calcium, potassium and chloride are essential nutrients for crops.
- Both calcium chloride and potassium chloride have natural origins.
- KCl is permitted by the NOSB to be used in soil application of organically grown crops, and CaCl<sub>2</sub> is not.
- When KCl is used, potassium ions being monovalent can disperse the soil particles, which can allow chloride in the soil structure to accumulate to a toxic level.
- Calcium ions of CaCl<sub>2</sub> flocculate soil particles that, in turn, improve drainage of chloride ions in the soil structure and move it away from the crop root zone.
- To minimize the danger of chloride toxicity and for the better wellbeing of the microorganisms of the soil, in soil application, CaCl<sub>2</sub> is much preferred over KCl.
- As KCl is allowed to be soil applied, CaCl<sub>2</sub> is requested to be permitted as well.

### ***References:***

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## **Salt Affected Soil: Problems and Solutions**

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### **Introduction**

A substantial percentage of agricultural land around the world is affected by high salt content. In many cases, salt affected soils are the result of using high salt containing water for irrigation purposes. However, adverse role of salt in soil is frequently misunderstood. Salt, being more precise common salt, is an electrolyte that is composed of  $\text{Na}^+$  and  $\text{Cl}^-$ . As in an aqueous environment, salt readily dissociates into  $\text{Na}^+$  and  $\text{Cl}^-$  ions in the presence of moisture in soil, it is always present in the form of  $\text{Na}^+$  and  $\text{Cl}^-$  ions.

The behavior of these dissociated ions in soil must be examined in terms of their affinity to the soil particles. Soil, in general, is composed of sand, silt, humus and clays. In the agricultural environment, these soil components are negatively charged. Of these, clay and humus also have high cationic exchange capacity (CEC). In such an environment, invariably, it is the  $\text{Na}^+$  ions that tend to adsorb into the soil structure.  $\text{Cl}^-$  ions, being like charged to the surface of the soil forming components, remain free, and move with the movement of moisture in the soil structure. This means, with adequate irrigation, they can be flushed out of the soil cross section to lower levels.

In terms of the role of  $\text{Na}^+$  and  $\text{Cl}^-$  in the crop physiology, while  $\text{Na}^+$  is toxic to crops,  $\text{Cl}^-$  is a micronutrient. In fact, plants may take up as much chloride as they do secondary elements such as sulfur. However, the salt problem in soil is mistakenly labeled as the chloride problem and not a sodium problem, which is the real culprit. This misrepresentation could possibly be attributed to the chemical analytical practices. Until recently, the analysis of sodium in a substrate or liquid phase has been a tedious task. In fact, for an accurate measurement, one needs a more expensive and sophisticated analytical instrument to measure sodium content. Other elements present in chloride form, such as calcium and magnesium, are much easier to measure. Measurement of chloride, on the other hand, is simple and relatively cheap. Portable analytical tools have also been available for some time. To estimate the extent of salt damage to the soil, it has been customary to measure the chloride content. This may be the reason chloride is frequently misunderstood as being the problem for the soil.

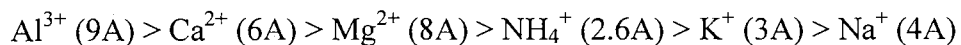
In this article, the problems associated with the salt affected soil are discussed. Treatment of such soil is recommended for bringing it back to the state that will allow the healthy growth of crops.

## Ionic Adsorption in Soil

The mode of adsorption of the ionic species that are present in the soil, or that are introduced to it, could be attributed primarily to the ion exchange phenomenon or to the physical or chemical adsorption of the ions to the soil structure. While cation exchange in soil is considered to be the major factor influencing the adsorption of the available ions in the system, adsorption of cations at the predominantly negatively charged surface of the soil forming particles is also possible.

The major exchangeable or adsorbing cations in soil are  $\text{Al}^{3+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$  and  $\text{H}^+$ . Other exchangeable cations, which are minor components of soil, but have nutrient values, are  $\text{Cu}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Mn}^{2+}$  and  $\text{NH}_4^+$ . Among these,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$  and  $\text{Na}^+$  are the dominant cations in most soils, and they are frequently measured for the evaluation of soil condition.

Valence is the major factor affecting the likelihood that a cation can be adsorbed. A trivalent  $\text{Al}^{3+}$  is more likely to adsorb than a divalent  $\text{Ca}^{2+}$ , which is more strongly adsorbed than a monovalent  $\text{Na}^+$ . However, for cations of similar valence, smaller cations with greater charge density per unit volume adsorb more strongly. The diameter of these ions includes the water molecules that are adsorbed onto them, forming a hydrated layer. It is the hydrated diameter of the cations that are involved in the adsorption at the particle surfaces. For this reason,  $\text{Ca}^{2+}$  with hydrated ionic radius of 6A adsorbs with much stronger energy than  $\text{Mg}^{2+}$  with hydrated radius of 8A. Similarly,  $\text{NH}_4^+$  or  $\text{K}^+$ , with their respective radii of 2.6A and 3A, adsorbs with much stronger energy than  $\text{Na}^+$  with hydrated radius of 4A. The general order of selectivity or replaceability, of some important exchangeable hydrated cations (hydrated radius of each ion is given in parenthesis) is as follows:



Among the above hydrated cations,  $\text{Al}^{3+}$  has the largest hydrated radius but, due to its higher valence, can adsorb strongest. However, at pH values higher than 4.0, as aluminum starts precipitating as aluminum hydroxide, there is a drastic reduction in the concentration of  $\text{Al}^{3+}$  ions in the soil environment. As most plants, or vegetation, sustain only at pH values higher than 5.0, use of an aluminum electrolyte is not an option for soil amendment. Consequently, calcium is the most effective element that could be used for soil amendment. Furthermore, aluminum is considered toxic to most of the crops.

The major factor affecting the absorption of cations in the soil structure is attributed to its Cationic Exchange Capacity (CEC), which represents the total quantity of negative charge available to attract positively charged ions present in the solution. It is expressed in terms of milliequivalent of negative charge per 100 g of oven dried soil (meq/100g). The CEC also represents the total meq/100 g of cations that can be held on the negative charge sites of the soil particles.



The CEC of a soil is strongly influenced by the nature and amount of mineral and organic compounds present. Soil containing high clay and organic matters have higher cationic exchange capacity than sandy soils that are low in organic matter content. The CEC of soil with different textures are given in Table 1.

**Table 1**  
**CEC Values of Different Soil Textures**

<u>Soil Textures</u>	<u>CEC (meq/100 g)</u>
Sands (light colored)	3 – 5
Sands (dark colored)	10 – 20
Loams	10 – 15
Silt Loams	15 – 25
Clayey Loams and Clay	20 – 50
Organic Soils	50 – 100

It is evident that soils with high clay content or organic matters have high CEC value, and will tend to adsorb larger amounts of cationic species. However, the capacity for the adsorption of cations will also depend on the base saturation of the soil, which is defined as *the percentage of total CEC occupied by base cations, e.g. Ca<sup>2+</sup>, Mg<sup>2+</sup>, K<sup>+</sup> and Na<sup>+</sup>*. The percentage base saturation is expressed as follows:

$$\% \text{ Base Saturation} = [\text{total bases (meq/100g)} / \text{CEC (meq/100g)}] * 100 \quad (1)$$

As the presence of Na<sup>+</sup> in the soil structure is critical to its fertility, it is important that they are replaced by more desirable cations. There is a direct relationship between the *Exchangeable Sodium Percentage (ESP)* of the soil and its CEC value. This can be expressed as follows:

$$\text{ESP} = [\text{Exchangeable Na (meq/100g)} / \text{CEC (meq/100g)}] * 100 \quad (2)$$

In soils, ESP is the most prevalent criteria to assess the sodium hazard. However, ESP does not apply to irrigation water since water does not have CEC sites. Instead of ESP, criteria used for irrigation water to quantify sodium induced hazard is *Sodium Adsorption Ratio (SAR)*. Traditional means of assessing Na status is to determine the quantity of Na, Ca and Mg in irrigation water, and report it as the SAR as follows:

$$\text{SAR} = \text{Na} / [(\text{Ca} + \text{Mg}) / 2]^{0.5} \quad (3)$$

Where the concentrations of Na, Ca and Mg are expressed in meq/L.

On empirical basis, for soil, a relationship between soil ESP and its SAR (saturated paste extract) has been determined as follows:

$$\text{ESP} = (1.475 * \text{SAR}) / (1 + 0.0147 * \text{SAR}) \quad (4)$$

When using the 1:5 extract for SAR determination (practiced in Australia), the relationship is:

$$\text{ESP} = 1.95 * \text{SAR} + 1.8 \quad (5)$$

The ESP value that may possibly cause the damage to the soil fertility depends on the mineralogical composition of the soil. For example, soil that may contain kaolinite clay with its relatively low CEC value may require as high as 40% Na saturation in its cationic exchangeable structure before damage can be noted. On the other hand, soil containing montmorillonite clay with its high CEC value may require only 15% Na saturation before the soil is damaged. However, in general, soil with low clay content is subjected to fewer problems as it has a low cationic exchange capacity and is also water and air permeable. It is, therefore, important that when a soil is evaluated along with ESP value its CEC is also determined.

### **Effect of Salt Contamination**

Salt contaminated soil can be classified into three groups: *saline*, *sodic* and *saline/sodic*.

Saline Soils have saturated Extract Conductivity ( $\text{EC}_{\text{se}} > 4$  mmhos (or mS)/cm,  $\text{pH} < 8.5$ , and  $\text{ESP} < 15\%$ . This means that most of the salt in the soil is still in the Free State, and sodium has not adsorbed into the soil structure, as yet. However, the presence of the soluble salt in soil is sufficient to interfere with vegetation, or plant growth. In such case, depending on the CEC value of the soil, the excessive soluble salts may be removed by leaching through irrigation, and the soil again can become normal. If the CEC value of the soil is low, irrigation with fresh water can alone resolve the problem. However, if the CEC value of the soil is high and attracts the  $\text{Na}^+$  ions from the salt solution, the adsorbed  $\text{Na}^+$  ions would need to be replaced by more preferred ions, such as  $\text{Ca}^{2+}$ .

Saline soils are often recognized by the presence of white crusts of salts on the surface. The damage to vegetation or plants in saline soil is primarily attributed to its high  $\text{EC}_{\text{se}}$ , which imparts high osmotic pressure of the soil solution that keeps moisture away from the root structure. This, in turn, could produce devastation on vegetation or plants.

Sodic Soils occur when  $\text{ESP} > 15\%$ ,  $\text{EC}_{\text{se}} < 4$  mmhos/cm, and  $\text{pH} > 8.5$ . This is the state after a certain period of soil being exposed to the salt solution, and the CEC value of the soil is adequate to adsorb  $\text{Na}^+$  ions into its structure. In such case, the adsorption of sodium disperses the colloidal fraction of the soil structure, and makes the soil more impermeable to moisture or air. The presence of sodium in the soil structure, in the sodic soil, creates nutritional disorder in most plants and vegetation. In contrast to saline soil, in the sodic soil, when free salt is leached out of its structure, the exchangeable sodium hydrolyses, and there is increase of pH. In this case, as the free salt is leached out of the soil structure, the  $\text{EC}_{\text{se}}$  value is lower than the saline soil.

Sodic soils are primarily found at the sites which were exposed to salt in the past. In the soil structure, sodium ions are adsorbed into the colloidal clay particles. Chloride, being like charged to the soil particles, drains out of the soil system and follows the movement of water. However, due to the dispersion of colloidal clay particles in the soil structure, soil becomes increasingly impermeable. The free chloride ions are also physically entrapped in to the impermeable soil structure. These entrapped chloride ions can be removed from the soil structure, by replacing the sodium ions with preferred calcium ions. Adsorption of calcium ions also destabilizes (floculate) the soil particles, making the soil structure more permeable.

*Saline/Sodic Soils* is a combination of the two states, which has high salt concentration with  $EC_{se} > 4$  mmohs/cm and high ESP  $> 15\%$ . However, it has  $pH < 8.5$ . This is a typical case of periodic occurrence of salt spills to the soil that has been exposed to salt for some time. Although, the return of the soluble salt to the soil that has achieved the sodic state may lower the pH, the management of this soil continues to be a problem until the excess salts, and exchangeable sodium, are removed from the plant or vegetation root zone, and favorable physical condition of soil is restored.

The high  $EC_{se}$  value of soil due to high concentration of salt increases the osmotic pressure of the soil solution. The roots of plants, and vegetation, under this environment, are unable to overcome the osmotic pressure of the soil, and they die from the lack of water.

As there is a statistical relationship between  $EC_{se}$  and osmotic pressure, on the basis of easily measurable  $EC_{se}$ , potential damage for the crops can be estimated. Apart from the lack of water being available to the roots in the high  $EC_{se}$  environment, high salt concentration in the soil solution also reduces the availability of essential plant nutrients. This results in a drop in plant yields, and in many cases there is total devastation.

There is no one threshold salinity level for all plants or vegetation. Generally, vegetables are more sensitive to salts than grains and grasses. A general crop tolerance level to salt has been developed by the US Salinity Laboratory (1954), as given in Table 2, which indicates no effect on the plant yields if  $EC_{se}$  value of the soil is lower than 2 mmhos/cm.

**Table 2**  
**General Crop Response as a Function of  $EC_{se}$**

<u><math>EC_{se}</math> (mmhos/cm)</u>	<u>Effect on Crop Yield</u>
0 – 2	None
2 – 4	Slight
4 – 8	Many crops affected
8 – 16	Only tolerant crops yield well
> 16	Only very tolerant crops yield well

At higher than 16 mmhos/cm values of  $EC_{se}$ , either there is drastic reduction in plant yield, or there is complete devastation. High sodicity, or high ESP, or high sodium content, of the soil also influences the crop yield, as shown in Table 3.

**Table 3**  
**Reduction in Crop Yield as a Function of Soil ESP**

<u>Type of Soil</u>	<u>ESP</u>	<u>Average % Reduction in Crop Yield</u>
Slightly Sodic	7 – 15	20 – 40
Moderately Sodic	15 – 20	40 – 60
Very Sodic	20 – 30	60 – 80
Extremely Sodic	> 30	> 80

### **Treatment of Salt Affected Soil**

As discussed earlier, the soil that is exposed to salt contamination goes through different phases. The soil freshly exposed to the brine solution, is at the saline stage. The majority of salt in this case is still in the free-state. With irrigation saline soils can be amended by leaching free salt present in its cross section. Leaching salt this way can remove it from the root zone to a lower level. The amount of irrigation water required will depend on the salt level or  $EC_{se}$  value of the soil, and on the quality of irrigation water being available. However, it should be noted that the introduction of calcium, as a cation source in the irrigation water, will not only improve the drainage of the salt content, but it will also ensure the liberation and removal of any  $Na^+$  ions that could have adsorbed into the soil structure.

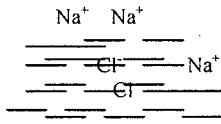
With time, when the saline soil is frequently irrigated naturally through rainfall, or artificially, the free salt solution drains to the lower level of the soil cross section. However, due to ion exchange phenomenon, the cationic  $Na^+$  species are adsorbed into the soil structure. The  $Cl^-$  species of the salt, on the other hand, do not adsorb at the like charged surface of the soil particles. A substantial portion of  $Cl^-$  species drains to a lower level. They remain free to be drained to even lower levels of the cross section with further irrigation. Yet, a significant portion of  $Cl^-$  species can be mechanically entrapped in the soil structure. This mechanical entrapment is further compounded by the fact that due to the adsorption of  $Na^+$  soil becomes dispersed. This is the typical state of sodicity. The ESP value of such soil will determine the degree of its sodicity. However, with subsequent exposure to salt, the sodic soil may reach a complex state of sodic/saline type.

It is important that the fates of  $\text{Na}^+$  and  $\text{Cl}^-$  species in the soil structure are clearly understood. The general chemical environment of most natural soils is such that  $\text{Cl}^-$  species do not adsorb at the particles. They remain free. However,  $\text{Na}^+$  species do adsorb at the predominantly negatively charged surface of the soil particles. Once the soil that is dispersed, due to the adsorption of  $\text{Na}^+$  species, is destabilized through amendment, its permeability and, therefore, its drainage property, is improved. This results in the removal of  $\text{Cl}^-$  species that are mechanically entrapped in the soil structure to a lower level. If an adequate amount of soil amendment and irrigation is applied, adsorbed  $\text{Na}^+$  species and free  $\text{Na}^+$  species that are mechanically entrapped in the soil structure, along with  $\text{Cl}^-$  species, can be liberated and removed from the soil cross section to a lower level. Soil at the root zone, thus, can be restored to the state of fertility.

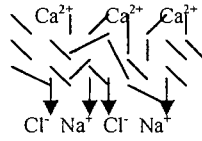
Amendment of salt affected soil, through cationic exchange, is postulated in Fig. 1. Due to the adsorption of  $\text{Na}^+$  species, the soil particles, particularly the clay fractions, are dispersed. The parallel plate like arrangement of the dispersed clay particles impedes the movement of moisture in the soil structure. As shown in Fig. 1 (A), while  $\text{Na}^+$  ions are adsorbed into the clay structure, the negatively charged  $\text{Cl}^-$  ions remain free, but entrapped in the dispersed clay system. The excess  $\text{Na}^+$  ions, that are not adsorbed in the clay structure, and are free, could also be mechanically entrapped in this system. When this soil is analyzed, it will show high  $\text{Na}^+$  and  $\text{Cl}^-$  ions. Nature of the presence of  $\text{Na}^+$  can only be determined through the measurement of the ESP of the soil in question.

Once the cationic additives are added to the salt affected soil for its amendment, the replacement of the adsorbed  $\text{Na}^+$  species in the clay structure, with more preferred cations, such as  $\text{Ca}^{2+}$ , would liberate  $\text{Na}^+$  from the system. The adsorption of  $\text{Ca}^{2+}$  ions also aggregates (flocculates) otherwise dispersed particles. This results in better drainage of moisture in the soil. With adequate irrigation, both mechanically and chemically liberated  $\text{Na}^+$  and  $\text{Cl}^-$  from the system will drain to a lower level, as shown in Fig. 1 (B). Removal of these species from the plant or vegetation root zone restores the fertility of soil. At this stage, if  $\text{Na}^+$  and  $\text{Cl}^-$  were measured at the root zone, significant reduction in their concentration would be noted.

As discussed earlier, calcium being divalent with small hydrated ionic radius and having favorable solution chemistry (calcium being predominantly present in  $\text{Ca}^{2+}$  form at pH up to 11.0) it is the preferred cationic species for the amendment of salt affected soil. There are a number of calcium compounds that are available for use. However, their effectiveness is based on the amount of calcium that could be available for cationic exchange in the soil structure. The availability of calcium in these compounds, for such use, depends on their water solubility. Limestone, lime, gypsum, and dolomite have been used for soil amendment. Yet, their effectiveness is grossly limited by their poor water solubility. Consequently, the amount of these materials that is needed to achieve the required degree of amendment can be very large. This could be restrictive, particularly in the regions where there are low rainfalls and artificial irrigation is expensive. Calcium chloride, due to its high water solubility, is a preferred additive for soil amendment. The effectiveness of these additives can be compared in terms of their solubility products that determine their water solubility, as shown in Table 4.



**A: Sodium Affected Dispersed Soil**



**B: Ca<sup>2+</sup> Amended Open Soil Structure**

**Fig. 1: Soil Amendment Postulate**

**Table 4**  
**Solubility Products of Some Soil Amendment**  
**Additives with Calcium Source (at 25°C)**

<u>Amendment</u> <u>Additives</u>	<u>Ca Content</u> <u>(wt %)</u>	<u>Solubility</u> <u>Product (K<sub>sp</sub>)</u>	<u>Water</u> <u>Solubility</u> <u>(g/100g)</u>
Limestone, CaCO <sub>3</sub>	40	9.95 x 10 <sup>-9</sup>	0.0007
Lime, Ca(OH) <sub>2</sub>	54	7.88 x 10 <sup>-6</sup>	0.147
Gypsum, CaSO <sub>4</sub> .2H <sub>2</sub> O	29.4	1.2 x 10 <sup>-6</sup>	0.0149
Dolomite*, CaMg(CO <sub>3</sub> ) <sub>2</sub>	21.7	5.26 x 10 <sup>-6</sup>	0.0423
Calcium Chloride**, CaCl <sub>2</sub>	36	8,883.66	82.0

\* Calculated based on the K<sub>sp</sub> of CaCO<sub>3</sub> and MgCO<sub>3</sub>

\*\* Calculated using the solubility data on CaCl<sub>2</sub>

Among the amendment additives in Table 4, though limestone and lime have higher calcium content than calcium chloride, they are very insoluble in water. Lime having higher solubility than limestone is limited to its use in acidic soil. Its use, in the alkaline or moderately acidic soil, would render the soil undesirably alkaline. Gypsum, though often used in soil amendment, is more forgiving from the soil pH point of view. However, its effectiveness in soil amendment is restricted by its extremely low water solubility. When compared against these additives, calcium chloride, being highly soluble in water, is the preferred additive in soil amendment. Readily available calcium speeds up the rate of remediation.

The rate at which soil restoration can be achieved by calcium chloride is demonstrated by this example. In this case, the salt spillage occurred due to a storage tank into a pasture land. Soil was classified as clayey loam. At this site, tilling was possible at the time of ReNew™ (a TETRA product, calcium chloride and urea blend composition) application. In this case, following the application of ReNew, the site was immediately irrigated with water. To evaluate the quick action of the additive, from the top 6-in. of the surface, a set of samples were taken after only three hours of treatment. They were analyzed for sodium content and for SAR and ESP values. Test results are summarized in

Table 5, which indicate that within the short period of three hours there were significant reductions in sodium content, SAR and ESP values of the treated soil. This behavior suggests a rapid rate of interaction between the cations of ReNew and the soil system.

**Table 5**  
**Remediation of Salt Contaminated Site at Kilgore, Texas**  
*(After Mishra et.al., 1999)*

<u>Sample</u>	<u>Na (mg/kg)</u>			<u>SAR</u>			<u>ESP</u>		
	<u>Before</u>	<u>After</u>	<u>% Red</u>	<u>Before</u>	<u>After</u>	<u>% Red</u>	<u>Before</u>	<u>After</u>	<u>%Red</u>
1	5626	1950	65	44	14.5	67	75.5	4.6	94
2	3993	1516	62	27.5	2.6	91	41.3	8.7	79

### Concluding Remarks

Problems associated with salt affected soil are primarily attributed to the  $\text{Na}^+$  and not the  $\text{Cl}^-$ . Adsorption of  $\text{Na}^+$  in the soil structure, mainly clays, while disperses and drastically impedes the moisture permeability of the soil, it is also toxic to most of the plants and vegetation. The most effective method of amending such soil is through the replacement of undesirable  $\text{Na}^+$  with other cations that functions as a nutrient to plants and vegetation.  $\text{Ca}^{2+}$  is the most effective cations for this role. As water is the workhorse for the cationic exchange process in the soil, solubility of the calcium containing chemical is critical to its effectiveness. Calcium chloride, being highly water soluble, which allows calcium to be readily available, is the most effective chemical additive that is used for the amendment of the salt affected soil.

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August 10, 2004

**CAL POLY**

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Subject: Petition for Calcium Chloride Use as Soil Application and Removal From “Prohibited” Status Except As a Foliar Application

Dear Mr. Pooler,

Allow me to introduce myself. I have taught courses in introductory soil science plus fertilizers and plant nutrition and soil microbiology and biochemistry plus team teaching fertigation for the past 30 years at Cal Poly. I have taught the soil and water chemistry course and have taught the graduate course on advanced soil fertility for many years. In addition, I have taught Human Values in Agriculture in the College of Liberal arts for 17 years and have team taught the course Organic Agriculture for the past 4 years. The last course is team taught with Dr. John Phillips (Horticulture and Crop Sciences Department). I have been presenting agronomic and soil fertility and water treatment talks throughout the state and nationally for the past decade. I am a member of the Soil Science Society of America, the American Society of Agronomy, the American Association for the Advancement of Science, the American Chemical Society and the American Society for Microbiology.

I will address what I understand to be the aspects of calcium chloride and potassium chloride use relative to organic agriculture. As I understand, soil use of potassium chloride is allowed as long as it is “applied in a manner minimizing chloride accumulation in the soil.” Foliar use of calcium chloride is allowed, but not soil use. For logical and scientific consistency, soil use of calcium chloride should be allowed similar to soil use of potassium chloride. The same annotation (i.e. applied in a manner minimizing chloride accumulation in the soil) still applies. In fact, very heavy soil applications of potassium chloride do create problems if not managed properly. Whereas, the same application of calcium chloride will not have the same detrimental effect. Potassium in high concentration can cause soil dispersion, whereas calcium will only flocculate the soil clay and humus particles. Applying calcium chloride could counteract an excess of potassium chloride if good drainage exists and proper management is followed.

As with any chemical material (manure, compost, natural mineral, etc.), these can be used appropriately or inappropriately. I am assuming people have enough sense to use all of these materials sensibly.

Certainly, excessive applications of chlorides in any form can be harmful to agriculture. One of the most common ways this can occur in organic agriculture is the over application of kelp, sea weed and other organic materials of marine origin. The total amount of chloride and of soluble salts should be carefully monitored by all organic farmers by determining the chloride level and soluble salts (Electrical Conductivity) levels of their soils periodically.

The chloride can cause severe chloride toxicity or excessive salt resulting in an excessive osmotic pressure condition in the root zone causing plants to wilt and inhibiting nutrient absorption by the plant roots.

However, we must remember, normal chloride applications are not a problem for any form of agriculture. Some sensitive plants such as all of the berry family and avocados are very sensitive to high chloride. Avocados have such high sensitivity they are harmed by fog from the ocean (as occurs in my back yard in Los Osos where we can see the ocean). Potatoes have a poor development of starch solidification when chloride is high. Tobacco has a harsh burning quality with high chloride. Other than these exceptions, plants can benefit from some chloride application to the soil.

I have identified nine major points about the use of calcium chloride I feel are pertinent to use in organic agriculture.

**One:** Chloride is recognized as being absolutely essential for plant growth. This has been known for half a century. Sea breezes often bring in enough chloride to supply the crop need by raining out the sodium chloride salt from the entrapped winds blowing off any ocean. However, in the past several years, wheat growers in Kansas have begun the application of magnesium chloride as a chloride supplement. This is because these farmers have mined out all of the soil chloride during over 150 years of extensive farming. Only trace levels of chloride are essential for normal crop production.

**Two:** Enhanced chloride nutrition has been identified as the major factor causing a decrease in disease incidence for a variety of diseases (mainly fungal). The original research attributed this effect to potassium. However, upon the realization the researchers used KCl (potassium chloride) in all of the original research and ignored the chloride effect, they now realize it is the chloride which provides the disease resistance. A level of about 50 to 100 pounds of chloride per acre is required to provide an adequate level of chloride for plants to maintain their ability to resist various plant pathogenic diseases. The chloride functions in this regard by increasing the osmotic pressure and thus the turgor pressure of the plant root and leaf cells. When the plant cells maintain full turgor, then they are much better able to prevent fungal mycelium from penetrating into the plant cell surface layer. Soil use of calcium chloride would provide the same benefit as would potassium chloride. This is true because the chloride is the ion providing the benefit for the plant.

**Three:** Increasingly, we are realizing the importance of having some level of soluble ions in the soil solution. This has become a critical problem in the management of western soils where they are irrigated with snow melt water. The same thing happens in soils dependent upon only rain water. Thus, irrigation water can be too pure for good use in agriculture. The soil can have so much good quality water (Electrical Conductivity EC < 0.20 mmhos/cm or < 0.20 dS/m) this lack of salts causes the clay particles to swell up and to disperse, causing soil sealing and water penetration problems. This problem can be overcome by the application of various salts to raise the soil EC to > 0.20. This higher salt level allows the soil clay particles to flocculate and to maintain good soil aggregation. This promotes good drainage and optimizes water, air and root movement through the soil. This is a key use for calcium chloride in western agriculture.

**Four:** We recognize it is critical to have some soluble salts in the soil to allow the cations [ + charged ions mainly calcium ( $\text{Ca}^{2+}$ ), magnesium ( $\text{Mg}^{2+}$ ), potassium ( $\text{K}^+$ ), sodium ( $\text{Na}^+$ ), and ammonium ( $\text{NH}_4^+$ ) ] to move from the soil CEC (Cation Exchange Capacity) sites into the soil solution. The CEC has a negative charge and holds these ions. Unless the soil solution has an adequate amount of negatively charged ions (Anions), the soil can not effectively release these essential cations into the solution. It is critical for these cations to be in the soil solution so they can be able to move to the root by mass flow of soil water compensating for the transpiration loss of water out the plant leaves. In addition, these ions must be free in the soil solution for absorption by the plant roots. Because of its high water solubility, calcium chloride is an excellent source of calcium cations. In fact, calcium chloride is more soluble and has a quicker effect than does the use of gypsum (calcium sulfate dihydrate) in this regard.

**Five:** A foliar application of either calcium or potassium is critical for rapid correction of a potential deficiency of these two ions. This foliar absorption can be enhanced by spraying the leaves with a light application of calcium chloride or potassium chloride or other soluble salts of these ions. Again, one can easily overdose these applications. Common sense will dictate the appropriate levels needed.

**Six:** The level of soluble potassium and calcium in the soil solution appears to be the most limiting factor determining the plant availability of these ions. The rate of release of these ions from the CEC sites (due to clay and organic matter or humus) is the critical rate factor. However, this rate depends upon having sufficient soluble salts in the soil solution for this release process to occur from the clay or humus surface into the soil solution. The potassium release rate has been shown to be a key limiting factor in some soils. Likewise, I believe the calcium release rate is a major limiting factor in some soils (although this has not been established in the public literature). I have an on going research project investigating this rate for calcium release. Soils having a very high level of extractable calcium by the soil test may have a calcium limitation due to a slow release rate of movement from the CEC sites to the solution. This is contrary to much of the previous belief about calcium nutrition for plant roots.

**Seven:** The drainage of soil is critical for all conditions in agriculture. One of the most critical problems I am seeing in both acidic soils with rainfall and snow melt water, or normal irrigation water is their application to the soil is creating problems of poor drainage. The irrigation water containing bicarbonate ( $\text{HCO}_3^-$ ) is the problem. This bicarbonate ion must be eliminated before it contacts the soil. If the grower does **not** eliminate the bicarbonate, then this bicarbonate reacts with the soluble soil calcium to form insoluble calcium carbonate ( $\text{CaCO}_3$  lime) as a precipitate inside the soil pores at the soil surface. This precipitate gradually accumulates and clogs these soil pores. Eventually, the water movement through the soil is strongly reduced. This is the major problem causing hidden difficulties of poor soil drainage. It is becoming an increasingly severe problem worldwide.

This problem can only be eliminated by appropriate use of an acidic compounds to the irrigation water. I believe sulfur dioxide ( $\text{SO}_2$ ) should be permitted for organic agricultural purposes as well as for all agricultural uses. Other strong acids create some other problems. If the grower uses calcium chloride, but irrigates with high bicarbonate water, then they create more calcium carbonate ( $\text{CaCO}_3$ ) as lime. This actually would accentuate the problem if they did not acidify the water when adding any form of soluble calcium.

**Eight:** The problems of the seventh point have a further concern. If the soluble salt level is low, then this will increasingly create a more severe problem due to changing the Sodium Adsorption Ratio (SAR). When the soluble calcium in the soil is converted into insoluble calcium carbonate ( $\text{CaCO}_3$ ) lime, the SAR value increases. The sodium level and the magnesium level are not affected, but the loss of soluble calcium can have a very harmful effect upon the soil. The higher the SAR in the soil, the greater the problem becomes. Usually, the problem becomes noticeable when the SAR value is above 6. It is very severe when the value exceeds 15. However, this overlooks the very real problem of the **very surface** of the soil. In the top one half inch, this reaction can occur causing increasing SAR values to 15 or 20 when the soluble calcium is depleted as indicated in item seven. Addition of calcium chloride through soil use will help remedy this problem especially when acidity has been added to keep this calcium soluble and active in the soil.

**Nine:** The use of calcium chloride is important as a method for increasing good water infiltration. The calcium goes onto the CEC and strongly flocculates the clay and humus particles. This actually enhances the soil's ability to transmit extra water deeper into the soil. Thus, calcium chloride can improve water infiltration, water percolation and water drainage if initial drainage exists. This does assume the soil has good water drainage in the subsoil. If good drainage does not occur, then it would not be appropriate to use a high chloride material.

I fully recognize the concern for not adding "chemical" compounds to a natural system. However, all organic systems are inherently "chemical". These natural systems are just the same "chemicals" as the synthetic chemicals. Certainly, I do not believe we should be applying synthetic organic pesticides, herbicides, or other products and should not allow biotechnology products to be used in organic agriculture.

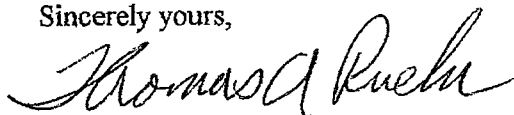
Organic agriculture has so few effective products, it is important to recognize what products can be allowed with a reasonable recognition of what is "chemical". Calcium chloride, potassium chloride, sulfur and sulfur dioxide are all natural chemicals or mineral sources. These substances can function effectively in an organic agricultural system without threatening the organic system. Calcium chloride can be applied to soil "in a manner minimizing chloride accumulation in the soil."

As I indicated previously, I realize any inappropriate use of any substance can be a problem. My Ph. D. involved a study of applying beef cattle feedlot manure at varying rates. We used high rates which did create harmful conditions. Likewise, excessive application of any of these inorganic or organic materials can create problems. However, normal levels have no adverse conditions for crop production for most crops (other than berries, avocados, potatoes, or tobacco).

I welcome any questions you may have about my comments and interpretations on the use of several potential substances for approval for use in organic agriculture. Soil use of calcium chloride should be allowed in organic agriculture similar to the approved use of potassium chloride. For the reasons previously described, soil use of calcium chloride provides numerous benefits which cannot be achieved through only the foliar use currently allowed under the NOP. Logically, one should treat all chloride materials similarly since they are all mineral sources and essentially perform as indicated in the nine points previously cited.

If you have any questions, please contact me by phone at 805-756-2552 (work) or 805-528-0151 (home where I am until mid-September), or by e-mail at [truehr@calpoly.edu](mailto:truehr@calpoly.edu) or by FAX 805-756-5412.

Sincerely yours,



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