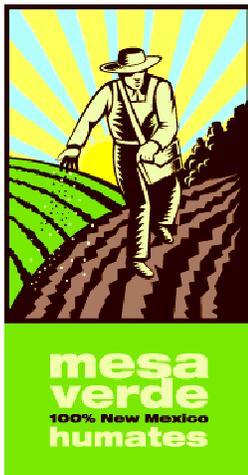


Received by NOP  
February 13, 2013



**Mesa Verde Resources**  
P.O. Box 1368  
Placitas, NM 87043

Lisa Brines, Ph.D.  
National List Manager  
USDA/AMS/NOP, Standards Division  
1400 Independence Avenue, SW  
Room 2648-South, Stop 0268  
Washington, D.C. 20250-0268

January 3, 2013

**RE: Petition for Inclusion in the National List – Magnesium Oxide (MgO)**

Mesa Verde Resources is petitioning to have magnesium oxide for inclusion in the National List within the following category:

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

Please see the attached petition prepared by Lawrence Mayhew of Eco Agri-Minerals on our behalf. Questions or requests for additional information may be sent either to me or to Mr. Mayhew.

We look forward to a positive response from NOSB.

Sincerely,

A handwritten signature in black ink, appearing to read 'Bruce Reid', is located below the 'Sincerely,' text.

Bruce Reid

Mesa Verde Resources  
P.O. Box 1368  
Placitas, NM 87043  
Phone: 505-771-4444  
Fax: 505-771-4452

**NOP Petition for Inclusion of Magnesium Oxide to the  
National List of Substances Allowed**

**Petitioner:**

Mesa Verde Resources  
Bruce Reid, President  
PO Box 1368  
Placitas, NM 87043  
505-362-3718  
505-362-3719

**Prepared by:**

Lawrence Mayhew  
Eco Agri-Minerals  
3899 Schreiner Road  
Spring Green, Wisconsin 53588  
608-583-3095  
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**Item A:**

Mesa Verde Resources is petitioning to have magnesium oxide for inclusion in the National List within the following category:

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

**Item B:**

*1. Substance's chemical or material common name:*

Magnesium Oxide (MgO)

*2. Manufacturer's name, address and telephone number and other contact information of the manufacturer of the substance listed in the petition.*

**Corporate Headquarters:**

Premier Magnesia LLC  
300 Barr Harbor Drive  
Suite 250  
W. Conshohocken, PA 19428  
Phone: +1-610-828-6929  
FAX: +1-610-828-8142

**Contact Person:**

Joe C. Brown  
4851 Chestnut Road  
Molino, FL 32577  
Phone (850) 587-2225  
Cell (850) 261-0807  
Fax (850) 587-2213  
[jbrown@premiermagnesia.com](mailto:jbrown@premiermagnesia.com)

*3. The intended or current use of the substance*

Magnesium oxide is intended to be used to control the viscosity of a clay suspension agent to prevent settling of materials suspended in water or other liquids. Currently, magnesium oxide is allowed in livestock production and is present in other approved materials.

*4. A list of the crop activities for which the substance will be used, the substance's rate and method of application.*

**4.1 – Crop Activities**

The substance is intended to be used in combination with other organic inputs applied as a liquid foliar on a wide variety of different agricultural, vegetable, fruit, and horticultural crops.

## 4.2 – Rate of Application

Magnesium oxide (MgO) is added in small quantities to an attapulgite clay during the processing of the clay (see Attachment #1) for the purpose of conditioning the viscosity of attapulgite clay when the clay is used as a suspension agent for finely ground humates. The amount of magnesium oxide added to the clay is  $\leq 0.99\%$  by weight and then the clay is blended into finely ground humates at 7.5% concentration, yielding a finished humate product with  $\approx 0.074\%$  MgO. The finished humate product is then put into spray tanks and diluted to various concentrations, with or without other organic agricultural inputs. The manufacturer's recommended rate of application of the diluted humate product is 1-2 lbs per acre when sprayed on foliage, resulting in an application of 0.0007 to 0.0014 pounds of MgO applied per acre.

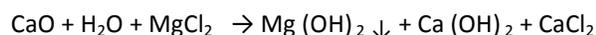
## 5. The source of the substance and detailed description of its manufacturing procedures from the basic components to the final product.

### 5.1 – Source of magnesium oxide in clay product.

Magnesium oxide is blended with mined (attapulgite) clay after the clay is crushed at a rate  $\leq 1\%$  of the clay product to aid in dispersion and gelling of the attapulgite clay when the clay is used as a suspension agent. (See Attachment #1).

### 5.2 – Manufacturing Process of magnesium oxide

Magnesium Oxide (MgO) products are made by calcining either magnesium carbonate ( $\text{MgCO}_3$ ) from the mineral magnesite or made from magnesium hydroxide ( $\text{Mg(OH)}_2$ ) derived from the "brine" process (NOSB, 2001) where salt brine pumped from deep wells containing relatively high concentrations of calcium chloride ( $\text{CaCl}_2$ ), magnesium chloride ( $\text{MgCl}_2$ ), and sodium chloride ( $\text{NaCl}$ ) are treated with either calcium oxide (lime,  $\text{CaO}$ )<sup>1</sup> or dolime ( $\text{CaO} \cdot \text{MgO}$ )<sup>2</sup> to precipitate magnesium hydroxide out of the brine solution. Then the magnesium hydroxide is dehydrated by heating to form magnesium oxide (NOSB, 2001; NOSB 2007; Shreve, 1967). The general chemical reaction for the treatment of seawater / brine to produce magnesium hydroxide and calcium chloride is;



However, treating brines with dolime (calcium magnesium oxide,  $\text{CaO} \cdot \text{MgO}$ ) is preferred because the production of calcium chloride and magnesium hydroxide is approximately twice as efficient as using calcium oxide, allowing smaller tanks and less volume of brine for equivalent production (Shand, 2006). Also, dolomitic limestones ( $\text{CaCO}_3 \cdot \text{MgCO}_3$ ) dissociate at lower temperatures than high calcium limestone ( $\text{CaCO}_3$ ), therefore requiring less energy for the production of the oxides (Considine, 1974). Consequently, the size of the manufacturing plant is much smaller and the cost of production considerably less (Shreve, 1967). The chemical reaction for the manufacture of magnesium hydroxide and calcium chloride using dolime is;



After precipitation from the brine, magnesium hydroxide is heated to produce magnesium oxide.



See Attachment #9 for a flow diagram of the brine process of manufacturing calcium chloride, magnesium hydroxide, and magnesium oxide.

<sup>1</sup> Historically, the correct term for calcium oxide is "Lime", and sometimes called "quicklime".

<sup>2</sup> Also referred to as dolomitic quicklime (Considine, 1974)

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

6.1 The Organic Materials Review Institute Generic Materials List (OMRI, 2011) summarizes magnesium as;

*Magnesium*

*Status: Allowed with Restrictions*

*Class: Livestock Feed Ingredients, Livestock Health Care*

*Origin: Synthetic/Nonsynthetic*

*Description: Synthetic magnesium may be obtained from magnesium carbonate, magnesium chloride, magnesium hydroxide, magnesium oxide, and magnesium sulfate. Nonsynthetic magnesium may be obtained from magnesium limestone and magnesium mica. NOP Rule: 205.237(a), 205.237(b)(2) & 205.603(d)(2)*

6.2 TAP Review of magnesium hydroxide/oxide

A Technical Advisory Panel (TAP) Review for magnesium hydroxide was performed for the National Organic Standards Board (NOSB, 2007) for use of magnesium hydroxide/oxide in organic livestock production.<sup>3</sup> The review found no deleterious effects from the manufacture and use of magnesium hydroxide, noting that it is made from magnesium oxide. The intended use of magnesium hydroxide as a livestock antacid is construed as drug claim in the United States, which is not the intended purpose of this petition.

Although the TAP review (NOSB, 2007) of magnesium hydroxide is specifically for organic livestock production, we feel that the TAP review supports this petition in that the scope of the review by necessity included compatibility with the goals of organic agriculture in general, and not just livestock production.

Furthermore, the TAP review for Magnesium Hydroxide implicitly and explicitly makes very little, if any, distinction between magnesium oxide and magnesium hydroxide in the review. For example, in the *Chemical Properties* section of the review, “magnesium oxide” appears eighteen times. On four occasions, the subject material is referred to as “magnesium hydroxide/oxide”, including the *Executive Summary*.

Although not specifically stated in the TAP Review for Magnesium Hydroxide, the reason why little if any distinction was made between the hydroxide and the oxide forms may be because magnesium hydroxide is simply the hydrated form of magnesium oxide, with both having very similar chemical properties. For example, magnesium oxide added to water is commonly referred to as milk of magnesia, which is a suspension of 7 to 8.5% magnesium hydroxide in water (USP, 1950).

In addition to the fact that magnesium oxide hydrate is allowed in livestock production, this petition will point out that magnesium oxide is present in other approved substances for organic crop production.

6.3 FAO/WHO Review

The Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) conducted a joint review of magnesium oxide, concluding that there is no limit on the acceptable daily intake (ADI) of magnesium oxide (FAO/WHO, 1965). Acceptable daily intake (ADI) refers to the maximum amount of a substance measured as mg/kg of body weight per day that an individual can ingest on a daily basis over their lifetime without any harmful effects. The ADI includes substances in food and anything that may come into contact with food during packaging and handling (WHO, 2004).

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<sup>3</sup> <http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5067078&acct=nopgeninfo>

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

7.1 - EPA

Not covered under the EPA High Production Volume (HPV) Program

7.2 - FDA

The code of federal regulations (CFR), title 21, Part 184-Direct food substances affirmed as generally recognized as safe lists magnesium oxide in §184.1431 as an ingredient used in food with no limitation other than current good manufacturing practice and affirms the ingredient as generally recognized as safe (GRAS) as a direct human food ingredient. See attachment # 7 for the US Food and Drug Administration GRAS opinion.

7.3 Codex

Magnesium oxide is listed as a food additive in Table 3 of the Codex General Standard for Food Additives (GSFA), and as such may be used in an extensive variety of foods and spices under the conditions of good manufacturing practices (GMP) as outlined in the Preamble of the Codex GSFA. The list of foods can be accessed at; <http://www.codexalimentarius.net/gsfaonline/additives/details.html?id=322>

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

CAS 1309-48-4

The magnesium oxide product is purchased in bulk. Please see Attachment #2 for a specimen product label with chemical and physical properties for the intended purpose.

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

9.1 – Physical Properties

Empirical formula: MgO

Appearance: Bulky white powder.

Odor: Odorless.

Solubility: 0.00062 g/100 ml water (cold); 0.0086 g/100 ml water @ 30° C <sup>4</sup>

Specific Gravity: 3.58 @ 25C

pH: 10.3

Boiling Point: 3600C

Melting Point: 2800C

Vapor Pressure (mm Hg) @20° C : ≈ 0

Hardness: 5.5

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<sup>4</sup> CRC Handbook of Chemistry and Physics, 46<sup>th</sup> edition, The Chemical Rubber Company, Cleveland, Ohio, 1964.

## 9.2 - Chemical Interactions

Magnesium oxide (MgO) is a white hygroscopic solid mineral that occurs naturally as the mineral Periclase. Synthetic MgO is commonly referred to as *magnesia* in manufacturing and commercial markets. MgO consists of a lattice of Mg<sup>2+</sup> cations and O<sup>2-</sup> anions held together by ionic bonds that readily convert to the hydrated mineral Brucite (Mg(OH)<sub>2</sub>, magnesium hydroxide) phase that can be reversed back to MgO by heating to separate it from water;



MgO is neither a strong acid nor a strong base. Instead it acts as a buffering agent when in aqueous solution. Buffering agents are materials that create an effective resistance to change in pH of aqueous solution when a strong acid or base is added. As MgO has no defined pKa and is relatively insoluble in water, it is unlikely to interact with anything other than strong acids. In fact it is used as a buffering agent in livestock and human products to control pH. For example, buffered aspirin is aspirin containing magnesium oxide as a buffering agent so the proper physiological pH of the aspirin will be maintained as it passes through the stomach. See Attachment #10 for a specimen label representative of that common usage.

## 9.3 - Toxicity and environmental persistence

As magnesium oxide/hydroxide is poorly absorbed by biological and physical systems, and as it is nearly insoluble in water, it has very low toxicity. The LD<sub>50</sub> for oral administration of MgO in mice was reported to be 810 mg/kg, and in rats was reported to be 3870 mg/kg in males and 3990 mg/kg in females (NIH, 2001). There is no limit on the acceptable daily intake (ADI) of magnesium oxide (FAO/WHO, 1965).

As with most metal inorganic oxides with negligible vapor pressure, MgO is not expected to partition to air. Once released to surface waters and moist soils, the fate of any substance depends on solubility and dissociation in water, so MgO/Mg(OH)<sub>2</sub> is very stable in soils and aqueous systems. Environmental processes (such as the presence of acids) may transform insoluble MgO/Mg(OH)<sub>2</sub> into more soluble ionic forms. Microbiological processes may also transform insoluble MgO/Mg(OH)<sub>2</sub> to more soluble forms. Such ionic Mg<sup>2+</sup> species may bind to dissolved ligands or sorb to solid particles in aquatic or aqueous media which may appear in sediments through the settling of suspended particles. When released to dry soil, MgO/Mg(OH)<sub>2</sub> will exhibit limited mobility and remain in the upper layer; some will leach locally into ground water and/or surface water ecosystems when soaked by rain or melt ice. Although metal ions are considered infinitely persistent in the environment because they cannot degrade further, the current state of science does not allow for an unambiguous prediction and interpretation of potential bioaccumulation especially under normal physiological conditions where the ion is essentially insoluble and may not be bioavailable.

## 9.4 - Environmental impacts from its use and/or manufacture

The environmental impact of MgO/Mg(OH)<sub>2</sub> is expected to be negligible as outlined in 9.2 above, especially in the quantities used for the purpose of acting as an adjunct to clay minerals as a suspension agent where application is expected to be in the range of 0.0007 to 0.0014 pounds of MgO per acre.

Manufacturing of MgO is regulated by various federal and state agencies where health and human safety as well as the potential for environmental contamination are highly controlled. The manufacturing process was previously reviewed in the NOSB petition for Magnesium Hydroxide and Calcium Chloride.

Magnesium oxide is safely used in numerous applications in preference to other materials because it is considered to be nonhazardous, environmentally safe, and nontoxic. Some of the applications include;

- waste water treatment
- toxic metal removal

- adsorption of dyes and excess phosphorus from industrial wastewater
- odor control
- treatment of acid mine drainage
- non-toxic flame retardant for clothing
- flue gas desulfurization
- hazardous spill clean up

#### 9.5 - Effects on human health

Magnesium oxide and the hydrated form magnesium hydroxide have been used safely for over a century (milk of magnesia) as a laxative and antacid. The NOSB TAP Review of magnesium hydroxide summarized the effects of large dosages of magnesium hydroxide and magnesium oxide on pages 14-15 of that review. The only concern expressed was for exposure to dry MgO fumes from heated materials, which is not the intended use of the material in this petition.

The Centers for Disease Control and Prevention does not list either magnesium oxide or magnesium hydroxide as chemical hazards.<sup>5</sup>

The code of federal regulations (CFR), title 21, Part 184-Direct food substances affirmed as generally recognized as safe lists magnesium oxide in §184.1431 as an ingredient used in food with no limitation other than current good manufacturing practice and affirms the ingredient as generally recognized as safe (GRAS) as a direct human food ingredient. See attachment # 7 for the US Food and Drug Administration GRAS opinion.

A 25 page report on magnesium oxide published by the National Institute of Health, National Toxicology Program reports magnesium as an essential mineral, and with the exception of very high and unusual exposures, ingestion of MgO does not appear to present a significant health problem to humans. The report can be accessed at;

[http://ntp.niehs.nih.gov/ntp/htdocs/Chem\\_Background/ExSumPdf/Magnesiumoxide.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/Chem_Background/ExSumPdf/Magnesiumoxide.pdf)

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

See Attachment # 3 for the MSDS provided by the manufacturer.

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

The intended purpose of using magnesium oxide is for the suspension of finely ground humic substances in aqueous suspension/solution. The addition of magnesium oxide to clays as a rheology/viscosity modifier has a long history as evidenced by numerous products in the market place and patents for that purpose, i.e. US patent numbers 6,906,010; 2,004,094,304; 20,020,174,697.

Attapulgites are a distinct class of clays that are a composite of smectite and palygorskite with magnesium and aluminum present in the silicate crystal lattice. The general formula of these clays is  $(Mg,Al)_2Si_4O_{10}(OH) \cdot 4(H_2O)$ . The range of the water of hydration in the clay formulations can vary with the processing to which the clay has been subjected in that the expandable characteristics of the hydrated smectite clays are dictated by the silicate lattice structure. As both the clays and humic substances can

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<sup>5</sup> NIOSH, Occupational Health Guidelines for Chemical Hazards, <http://www.cdc.gov/niosh/docs/81-123/>, accessed 1/3/2013.

carry a predominately negative charge under certain cation and pH conditions, the increase in negative ion concentration as the result of the treatment with magnesium oxide increases the tendency of clays and humic substances to repel each other, preventing settling and aggregation.

Through substitution, common metal cations such as sodium ( $\text{Na}^+$ ) and calcium ( $\text{Ca}^{2+}$ ) that can be co-present in the water of hydration, provide electrical neutrality to clays. Substitution by other cations with lower electropositive influence in aqueous solutions, such as magnesium ( $\text{Mg}^{2+}$ ), can occur within the crystalline lattice of the smectites, thus providing a relative increase in negative charge to the lattice structure. The difference in the electropositive effect between sodium and calcium cations compared to magnesium cations is demonstrated by the potential difference generated in solution, where sodium and calcium cations, + 2.54 v and +2.28 v respectively, have nearly double the potential for positive voltage production compared to magnesium, +1.21 v (Smith, 1910).

Because of numerous dynamic interactions, humic substances and clays are so intimately associated in soil systems, it is nearly impossible to physically distinguish the two components from each other (Cornejo and Heramosín, 1996; McKeague et al, 1983). One of the interactions is surface charge. As the overall electronegative charge of a clay is increased by the addition of MgO, the interaction of the clay with deprotonated  $[-\text{COO}^-]$  binding sites on humic acids and the concomitant increase in surface charge results in an increase in intermolecular repulsion that in turn resists metal cation ( $\text{M}^{n+}$ ) binding, precipitation, and settling of the humates. The deprotonated humic acids undergo considerable conformational changes in molecular structure in reaction to the change in pH (Tombacz and Rice, 1999) manifested by an increase in surface charge density (Kipton et al, 1992), resulting in increased entropy in the aqueous media through hydrophobic interactions (Tanford, 1980) that help suspend the amphiphilic<sup>6</sup> humic acids while leaving the fulvic acids in solution (Tipping, 2002).

12. A “Petition Justification Statement” which provides justification for any of the following actions requested in the petition for inclusion of a Synthetic on the National List, §§ 205.601, 205.603, 205.605(b);

*In addition to the comments made in 6.2 above regarding the TAP review for magnesium hydroxide (NOSB, 2007), where we contend that the TAP review supports this petition because the scope of the review addressed the compatibility of magnesium oxide with organic agricultural systems, we submit the following Justification Statement and further supporting evidence in sections 12.2 to 12.9.*

#### Justification Statement

Compared to NOP approved synthetic humate liquid extracts, where up to 50% of the nonsynthetic material is discarded during manufacturing, nonsynthetic liquid humates do not use caustic alkali or corrosive acid solvents during manufacture, require less energy to manufacture, are more versatile, are compatible with a greater number of cultural practices, and the chemical and structural properties of the naturally occurring active components are preserved.

The transport, handling, and soil application problems associated with dry (dusty) mined humates are overcome also. Because the major portion of nonsynthetic liquid humic substances are insoluble in water, they must be finely ground to less than 50 microns in size ( $< 0.050\text{mm}$ )<sup>7</sup>, thus requiring some kind of suspension agent to keep them suspended in water. Natural clays that are physically modified by the addition of small quantities of magnesium oxide are effective suspension agents for micronized humates.

Additionally, magnesium oxide is a non-toxic material commonly used in feeds and foods. It is also present in some NOP approved materials.

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<sup>6</sup> having both hydrophobic and hydrophilic properties

<sup>7</sup> Commonly referred to as micronization or size reduction

## 12.1 – Current NOP allowed humic materials as interpreted by OMRI<sup>8</sup>

### *Humic Acids – nonsynthetic*

*Status: Allowed*

*Origin: Nonsynthetic*

*Class: Crop Fertilizers and Soil Amendments, Crop Management Tools and Production Aids*

*Description: Naturally occurring deposits of humic acids and water extracted humates. NOP Rule: 205.203(d)(2) & 205.601(j)(3) A mined substance of low solubility. As plant or soil amendments...*

*Humic acids—naturally occurring deposits, water and alkali extracts only.*

### *Humic Acids – alkali extracted*

*Status: Allowed*

*Class: Crop Fertilizers and Soil Amendments, Crop Management Tools and Production Aids*

*Origin: Synthetic*

*Description: Also called humic acid derivatives. Extracts from nonsynthetic humates by hydrolysis using synthetic alkaline materials are permitted. Includes humates that are extracted using potassium hydroxide, provided that the synthetic extractant is limited to that amount necessary for extraction and is not used to fortify the potassium analysis.*

*NOP Rule: 205.601(j)(3) As plant or soil amendments... Humic acids—naturally occurring deposits, water and alkali extracts only.*

### *Humates*

*Status: Allowed*

*Class: Crop Fertilizers and Soil Amendments*

*Origin: Nonsynthetic*

*Description: Acceptable if derived from leonardite, lignite, or coal; not acceptable if fortified with synthetic nutrients.*

*NOP Rule: 205.203(d)(2) A mined substance of low solubility.*

## 12.2 – Nonsynthetic micronized humates

Natural humic substances stimulate biological activity, foster cycling of resources by making fertilization more efficient, conserve water, promote ecological balance, conserve biodiversity and improves soil and water quality. For an extensive review of the benefits of humic products used in agriculture, see MacCarthy and Rice (1994). The importance of using nonsynthetic humic substances in organic agriculture is supported by a partial bibliography as part of this petition (Attachment #6 – Benefits of Humic Acids, Fulvic Acids, and Humic Substances). Only nonsynthetic humic substances can deliver all of the benefits summarized in Attachment #6.

An effective suspension agent is key to making a suspended humate stay in suspension. The author of this petition has personally experimented with a wide range of materials, including saponites and sepiolites, (magnesium rich clays), bentonites, montmorillonites, etc., and has yet to discover another substance, other than magnesium oxide, that will modify clays in such a manner so as to effectively suspend humic substances while simultaneously preventing recrystallization of any fertilizer or micronutrient salts that may be in solution. Reducing the growth of crystals is necessary to prevent the plugging of spray nozzles during spray applications. The use of the magnesium oxide-modified clay also increases the viscosity of aqueous suspensions of humates, which in turn delays settling and keeps the solids from forming a hard cake when settling eventually occurs.

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<sup>8</sup> Organic Materials Review Institute (OMRI) Generic Materials List

- *Explain why the synthetic substance is necessary for the production or handling of an organic product.*

### 12.3- Explanation

In order to provide the physical conditions needed to modify clays as suspension agents, the magnesium oxide (MgO) must be manufactured to certain specifications under highly controlled conditions. Some of the properties that are critical to the effectiveness of MgO for the purpose of aiding clays as suspension agents include, but are limited to;

- morphology
- crystallography
- surface structure
- effective surface area
- particle size
- purity
- bulk density

For a comprehensive review of the chemical and physical characteristics that are controlled during manufacturing so that the final product is suitable for its intended purpose, reference is made to: Shand, Mark A., *The Chemistry and Technology of Magnesia*, Wiley Interscience, 2006, ISBN: 978-0-471-65603-6. See Attachment #2 for more specific specifications.

- *Describe any non-synthetic substances, synthetic substances on the National List or alternative cultural methods that could be used in place of the petitioned synthetic substance.*

### 12.4 – Non-synthetic Substance as Substitutes for Petitioned Synthetic Substance

#### 12.4.1 – Periclase and Brucite

Periclase (MgO) and its hydrated alteration product, Brucite (Mg(OH)<sub>2</sub>), are naturally occurring forms of magnesium oxide and magnesium hydroxide respectively. However, because of the rarity of Periclase and the fact that Brucite resources are used exclusively for further manufacturing of other products, there are no commercially available sources of these minerals in the United States as a raw non-synthetic mined material (Kogel, 2006). Additionally, the purity, crystalline size, morphology, and specific surface area of the magnesium oxide must meet certain specifications as outlined in 12.3 above that are not presented in these non-synthetic sources. These physical characteristics are highly controlled during manufacturing in order to meet specifications designed to control the kinetics of the materials in aqueous suspensions (Kimyongur and Scott, 1986; Shand, 2006).

#### 12.4.2 – Dolomitic Limestone

Nonsynthetic magnesium may be obtained from magnesium limestone and magnesium mica. Magnesium limestone, better known as dolomitic limestone, which is primarily composed of calcium magnesium carbonate (CaCO<sub>3</sub> • MgCO<sub>3</sub>), cannot be used for the purpose of aiding clay suspension agents because it does not meet the chemical, kinetic, or physical specifications required.

#### 12.4.3 – Phlogopite

Magnesium-mica (phlogopite) is a brownish magnesium mica consisting of a hydrous silicate of potassium, magnesium, and aluminum, occurring principally in metamorphic limestones and ultrabasic rocks. Its chemical formula is: KMg<sub>3</sub>AlSi<sub>3</sub>O<sub>10</sub>(OH)<sub>2</sub>. It is a mineral of the phyllosilicate class of the isomorphous biotite-phlogopite series. Impurities include Na<sub>2</sub>O (up to 8 percent), TiO<sub>2</sub> (up to 9 percent), and MnO (up to 18 percent), as well as rubidium, cesium, and barium (MSA, 2001). Again, it does not meet the specifications for the intended purpose.

#### 12.4.4 - Wood ash

The NOP considers wood ash an approved nonsynthetic organic input contains magnesium oxide as a result of ignition (Misra et al, 1993). Magnesium substances contained in plant tissues, including organically bound and inorganic magnesium  $Mg^{2+}$  cations (Marschner, 1995) are thermally transformed to magnesium oxides (Misra et al, 1993) by the ignition of plants.

Approximately one million tons of wood ash is applied to agricultural soils annually in the United States at about 1 to 4 tons per acre (BMP, 2010). The median concentration of elemental magnesium (Mg) in hardwoods and softwoods is approximately 0.51% (Duke, 2012) prior to burning. After burning, the analyzed content of elemental magnesium (Mg) in wood ash derived from a variety of soft and hardwoods is approximately 6.5% (Misra et al, 1993). As wood ashes are composed of a mixture of calcium and magnesium carbonates/oxides when burned at low temperatures and primarily calcium and magnesium oxides when burned at higher temperatures (Misra et al, 1993), the magnesium oxide content of wood ash can be conservatively calculated ~4.4% by weight. Then, approximately 44,000 tons of magnesium oxide from wood ash is applied to agricultural acreage per year, which is about 88 pounds per acre.

The magnesium oxide in wood ash does not meet the purity standards or physical specifications for use as a clay viscosity modifier suitable for aqueous suspension agents.

#### 12.4.5 – Pelletized Nonsynthetic Humates

Although the use of nonsynthetic humates containing all of the original natural humic fractions is preferred, only dry mined materials can provide the complete material. Unfortunately, dry mined humates are very dusty, making handling, transport and field application of the materials impractical.

Pelletized dry humates are available in the market place in order to overcome the inherent physical problems of the natural materials, but the cost of the energy intensive agglomeration process for pelletizing humates can be substantial enough so as to either restrict or eliminate their use in organic crop production programs.<sup>9</sup> Additionally, synthetic humic acids are only compatible with alkali media, incompatible with acids, and insoluble in neutral media, thus restricting their use. Although fulvic acids are compatible with both acid and alkali media, they too are expensive to manufacture due to the use of caustic extracts and both humic acids and fulvic acids are only a fraction of the natural nonsynthetic material.

#### 12.5 – Synthetic Substance as Substitutes for Petitioned Synthetic Substance

None known

#### 12.6 – Further Justification

##### 12.6.1 – Non-synthetic calcium chloride manufacturing and purity

The approved use of calcium chloride for organic crop production, food ingredients, and livestock minerals (OMRI, 2011) has a direct bearing on this petition in that magnesium oxide is present in calcium chloride as a result of the manufacturing process.

Calcium Chloride appears in the NOP rules in two places;

*§ 205.602 Nonsynthetic substances prohibited for use in organic crop production*

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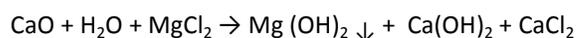
<sup>9</sup> Cost is not generally a criteria considered by the NOSB, but in reality, it *is* a criteria for farmers. As the National Organic Standards Board is part of the USDA Agricultural Marketing Service, cost to farmer to consumer *is* a factor in agricultural marketing.

*(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.<sup>10</sup>*

*§ 205.605 Nonsynthetic substances prohibited for use in organic crop production*

*(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.*

The NOP classifies calcium chloride as a non-synthetic material derived from “brine” process, which is a process where natural brines containing calcium chloride and magnesium chloride are treated with calcium oxide (lime from calcined limestone, CaO) in order to chemically separate the calcium chloride (CaCl) from the brine solution (NOSB, 2001). See Attachment #9 for a general explanation of the brine process. The chemical reaction for the manufacture of calcium chloride is;



Brines are typically treated with calcium magnesium oxide (dolime) from calcined dolomitic limestones instead of calcium oxide (lime) because magnesium oxide is more efficient at separating the magnesium chloride from the calcium chloride (Shand, 2006).



As a result of precipitating the Mg (OH)<sub>2</sub> from either reaction above, calcium oxide (CaO) and magnesium oxide (MgO) are associated with the calcium chloride appearing as the hydrated products calcium hydroxide (Ca(OH)<sub>2</sub>) and magnesium hydroxide (Mg (OH)<sub>2</sub>) in the calcium chloride. This is evidenced by the typical purity standards for calcium chloride which allow a minimum concentration of 93% calcium chloride and a 5% concentration of magnesium hydroxide (FAO, 2012; NOSB, 2001). ASTM standard specification for calcium chloride purity includes calcium and magnesium hydroxide as contaminants (ASTM, D98). According to the TAP review on calcium chloride (NOSB 2001), these purity standards are only obtainable if the brine is treated with calcium oxide.

As the NOP §205.602(c) allows calcium chloride manufactured by the brine process reaction to be applied to organic crops as a foliar application, and as it is also allowed in food production (OMRI, 2011), magnesium oxide and its hydrated form magnesium hydroxide is currently applied to crops and organic foods. The presence of magnesium oxide/hydroxide in calcium chloride is unavoidable as calcium chloride is in contact with magnesium oxide/hydroxide during manufacturing, and as internationally recognized purity standards for calcium chloride allow the presence of up to 5% magnesium oxide, it is logical to include magnesium oxide as an allowed substance.

#### 12.6.2 – Magnesium sulfate manufacturing and purity

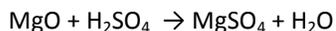
Magnesium sulfate is included on the National List as a synthetic substance allowed for use in organic crop production as a soil amendment if a magnesium deficiency is documented (§205.601(j)(5)). Magnesium sulfate is also included on the National List as a synthetic substance allowed for use in organic livestock production (§ 205.603(d)(2)), Processing and Handling (§ 205.605(a), and as livestock minerals (OMRI, 2011).

The synthetic form of magnesium sulfate is produced by a chemical reaction in which either magnesite ore (MgCO<sub>3</sub>) or magnesium hydroxide (Mg(OH)<sub>2</sub>) obtained from seawater brine (the most common method) is calcined to produce magnesium oxide (MgO). Magnesium oxide is

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<sup>10</sup> The restriction on the use of nonsynthetic calcium chloride in § 205.602 arises from the fact that the amount of chlorine applied to a crop needs to be restricted.

then reacted with sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), producing magnesium sulfate;



This method is typically used to produce high purity Epsom salts (MgSO<sub>4</sub>) intended for many uses, including agriculture (NOSB, 2011). However, as it is not commercially feasible to produce 100% pure magnesium sulfate on a scale suitable for food and agricultural applications, purity standards for magnesium sulfate range anywhere from 62-70% MgSO<sub>4</sub> (NIH, 2012) to 99.5% MgSO<sub>4</sub> for food grade (FAO, 2007). The FAO (2007) specification of 0.5% impurities in food grade MgSO<sub>4</sub> states that some of the contaminants are alkali oxides from the manufacturing process, i.e. magnesium oxide/hydroxide. One OMRI Listed tech grade Epsom salts product sold for organic agricultural purposes (see Attachment # 4) may contain as much as 0.10% magnesium oxide (Attachment # 5), while some agricultural grade magnesium sulfates available in the market place may contain as much as 16.5% magnesium oxide<sup>11</sup> depending on the source.

As magnesium oxide is typically used in the manufacturing process of magnesium sulfate, and as some magnesium oxide is unavoidably present in magnesium sulfate, and as the concentration of magnesium oxide present in magnesium sulfate is not regulated by the NOP, magnesium oxide/hydroxide is being applied to soils where magnesium sulfate is used.

- Describe the beneficial effects to the environment, human health, or farm ecosystem from use of the synthetic substance that support its use instead of the use of a non-synthetic substance or alternative cultural methods.

#### 12.7 – Environmental Beneficial Effects

In order to provide the full benefit of humic substances as outlined in Attachment #6, it is necessary to use naturally occurring nonsynthetic humic substances. Micronized humic substances provide these benefits, but an effective suspension agent is required as a rheology/viscosity modifier.

#### 12.8 – Impact of Manufacturing on the Environment

The use of liquefied synthetic humic acids and fulvic acids is a NOP approved organic crop production practice. However, synthetic humates are extracted fractions that lack the complete chemical identity of the original natural materials. Liquid synthetic humic acids are operationally defined as the alkali soluble fraction of humic substances that precipitate out of solution after the alkaline extract is acidified to pH 2 or less, and fulvic acids are operationally defined as the neutral and acid soluble fractions recovered after acidification of the alkaline extracted fraction (Stevenson, 1994; AAPFCO, 2013; HPTA, 2012). By definition, neither humic acids nor fulvic acids contain humin, which is the insoluble highly stable complex carbon portions of humic substances that have detoxifying properties, and make up anywhere from 30 to 50% of nonsynthetic humic substances (Rice, 2001; , Clapp et al, 2001). The humin portion is discarded after manufacturing.

As humic acids and fulvic acids are extracted from nonsynthetic materials with strong alkali and strong acids, and as the structure of humic substances is sensitive to pH changes (Schnitzer, 1978; Piccolo et al, 2000), the use of strong alkali, such as potassium hydroxide, most certainly changes the structure of the nonsynthetic materials.

### 13. A Confidential Business Information Statement

none

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<sup>11</sup> [http://shandongrunzi.en.alibaba.com/product/497508970-210797238/Various\\_Purity\\_of\\_magnesium\\_sulphate\\_99\\_5\\_98\\_96\\_fertilizer\\_white\\_crystal\\_MgSO4\\_7H2O\\_Mg9\\_min\\_.html](http://shandongrunzi.en.alibaba.com/product/497508970-210797238/Various_Purity_of_magnesium_sulphate_99_5_98_96_fertilizer_white_crystal_MgSO4_7H2O_Mg9_min_.html)  
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Attachment #1 - Manufacturing of Min-U-Gel 200™



December 17, 2012

Mr. Bruce Reid  
Mesa Verde Resources  
P.O. Box 15159  
Rio Rancho, NM 87174

Thank you for your interest in our Min-u-Gel attapulgite products. We are happy to provide you with the information you need to achieve OMRI certification.

**Products:**

Min-u-Gel products are based on attapulgite clay, a hydrated magnesium alumino-silicate and a principal member of the fuller's earth family of clay minerals having the ideal formula:  $3\text{MgO} \cdot 1.5\text{Al}_2 \cdot 1.5\text{Al}_2\text{O}_3 \cdot 8\text{SiO}_2 \cdot 9\text{H}_2\text{O}$ . Min-u-Gel attapulgite products are distinguished by their unique thixotropic thickening, gelling and suspension properties in liquid systems. We offer a wide range of products tailored to the needs of a multiple of industrial applications in fertilizer, pesticides, building and construction products, petroleum drilling, adhesives, caulks, sealants, paint & coatings, and many more.

**Manufacturing Processes:**

Min-u-Gel products are made from high quality attapulgite mineral deposits located in southwestern Georgia (Decatur County) and northwest Florida (Gadsden County). Our processing plants are in Climax, GA and Quincy, FL. The crude is exposed by strip mining and transported to the Climax plant where it is crushed, dried and classified. Additional processing may be needed at the Quincy plant for certain products, including different methods of sizing and forms of packaging. Products are shipped from both plants.

**Additives:**

As with any natural mineral, Min-u-Gel products contain small amounts of other naturally occurring minerals, such as kaolin, smectite, montmorillonite, calcium carbonate, silica, etc. These are not considered additives. The only non-natural material our products may contain is magnesium oxide (MgO). It may be used at times to assist in developing Min-u-Gel's thixotropic properties. We consider the addition levels of MgO to be proprietary and are not able to give specific values either in general or on a per shipment basis. We can however assure you that the addition rate will not exceed 1.0%.

I hope this is satisfactory for your needs. Please let me know if you need any further questions regarding our products.

Regards,

A handwritten signature in black ink that reads "Jeff Carr".

Jeffrey B. Carr  
Director of Sales, North America

6 N. Park Drive, Suite 105, Hunt Valley, MD 21030

[info@activeminerals.com](mailto:info@activeminerals.com) 410.825.2920

## Attachment #2 - Product Label



### Product Data

**MAGOX**  
® 98  
HR

MAGOX® 98 HR is a synthetic, reactive technical grade of finely sized, high purity magnesium oxide produced from deep-well brine. It is designed specifically for use in chemical process applications where a rapid reaction rate is necessary.

Chemical Analysis by X-ray Fluorescence			
	Typical	Maximum	Minimum
(As-is basis)			
Loss on ignition (1000°C), %	3.00	5.0	
Chloride (Cl), %	0.30	0.5	
Sulfate (SO <sub>3</sub> ), %	0.05	0.3	
(Loss-Free Basis)			
MgO, %	98.20		97.0
CaO, %	0.80	1.0	
SiO <sub>2</sub> , %	0.35	0.5	
Fe <sub>2</sub> O <sub>3</sub> , %	0.15	0.3	
Al <sub>2</sub> O <sub>3</sub> , %	0.10	0.2	
Physical Properties			
Specific surface area (m <sup>2</sup> /g) B.E.T. nitrogen adsorption	65	76	52
Mean particle size (microns) X-ray sedigraph	5		
Caustic magnesia activity (secs) (Acetic acid)	8		
Loose bulk density, lb/ft <sup>3</sup> (g/cm <sup>3</sup> )	22 (0.35)		
Tapped bulk density, lb/ft <sup>3</sup> (g/cm <sup>3</sup> )	32 (0.51)		
Screen analysis, % (U.S. sieve series)			
- 100 mesh			99.9
- 325 mesh	99.5		99.0

#### PACKAGING AND STORAGE:

Available in bulk and 25 kg net weight multiwall paper bags. Forty bags to a pallet which are double stretch-wrapped for extra protection. Store in a dry area protected from moisture. Material should be consumed within six months. If the contents of a bag are not entirely used after opening, the bag should be immediately resealed. Also available in 1000 kg bulk bags.

MC-FPS-800 MAS:  
08-19-11

*Magox is a registered trademark of Premier Magnesia, LLC* Premier  
Magnesia, LLC, 300 Barr Harbor Drive, Suite 250 West Conshohocken, PA  
19428  
Tel: 610-828-6929  
<http://www.premiermagnesia.com>

# Attachment # 3 - MSDS Magnesium Oxide

## MATERIAL SAFETY DATA SHEET

PREMIER CHEMICALS

MSDS No.: 2800

Date Prepared: 1/06

Phone: PREMIER CHEMICALS: 1-800-227-4287

This Revision: 12/06

CHEMTREC, 24-Hr Emergency Assistance: 1-800-424-9300

### SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material / Product Name(s): **MAGOX® 98 HR**

CAS Number: 1309-48-4

Chemical Family: Inorganic Oxide

General Use: A high reactivity, chemical grade magnesium oxide powder.

Manufacturer / Supplier: PREMIER CHEMICALS

300 Barr Harbor

Suite 250

West Conshohocken, PA 19428-2998

### SECTION 2. INGREDIENTS / COMPOSITION

Ingredient name:	CAS Number:	Percent:	IARC/NTP/OSHA:	Exposure Limits:
Magnesium Oxide	1309-48-4	100		No
Nuisance Particulate OSHA				

PEL:TWA 15mg/m<sup>3</sup>;respirable:

5mg/m<sup>3</sup>. ACGIH TLV:TWA

Total dust:10mg/m<sup>3</sup>; respirable

dust: 5mg/m<sup>3</sup>.

#### Typical Chemical Analysis, Wt.% (Loss Free Basis)

LOI (1000°C)	3.00	(includes 0.05% SO <sub>3</sub> and 0.3% Cl)
SiO <sub>2</sub>		0.35
Fe <sub>2</sub> O <sub>3</sub>	0.15	
Al <sub>2</sub> O <sub>3</sub>	0.10	
CaO		0.65
MgO	98.20	

The oxides shown in the typical chemical analysis do not exist in the magnesium oxide as free, uncombined oxides, but are combined in complex mineralogical phases.

### SECTION 3. HAZARDS IDENTIFICATION

#### HMIS

HEALTH HAZARD	1 - SLIGHT
FLAMMABILITY HAZARD	0 - MINIMAL
REACTIVITY HAZARD	1 - SLIGHT
PERSONAL PROTECTION	B - Glasses, Gloves

### Attachment # 3 - MSDS Magnesium Oxide (cont't)

#### **EMERGENCY OVERVIEW:**

White, free flowing powder. Will react with water generating heat. Not a fire or spill hazard. Low toxicity. Dust is classified as a "nuisance particulate not otherwise regulated".

**Target Organs:** Chronic overexposure may cause lung damage.

**Primary route(s) of entry:** Inhalation

**Acute effects:** Excessive exposure to airborne particulate may cause eye and upper respiratory irritation.

**Chronic effects:** Product dust is classified as a "nuisance particulate, not otherwise regulated" as specified by ACGIH and OSHA. The excessive, long-term inhalation of mineral dusts may contribute to the development of industrial bronchitis, reduced breathing capacity, and may lead to the increased susceptibility to lung disease.

#### **Signs & symptoms of overexposure:**

**Eye contact:** Particulate is a physical eye irritant.

**Skin contact:** Prolonged contact may cause slight skin irritation.

**Inhalation:** Chronic overexposure by inhalation of airborne particulate may irritate upper respiratory system as well as the throat.

**Ingestion:** An unlikely route of exposure. If ingested in sufficient quantity, may cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

#### **SECTION 4. FIRST AID MEASURES**

**Eye contact:** Flush eyes, including under the eyelids, with large amounts of water. If irritation persists, seek medical attention.

**Skin contact:** Wash affected areas with mild soap and water.

**Inhalation:** Remove victim to fresh air. If not breathing, give artificial respiration. Get immediate medical attention.

**Ingestion:** Ingestion is an unlikely route of exposure. If ingested in sufficient quantity and victim is conscious, give 1-2 glasses of water or milk. Never give anything by mouth to an unconscious person. Leave decision to induce vomiting to qualified medical personnel, since particles may be aspirated into the lungs. Seek immediate medical attention.

#### **SECTION 5. FIRE FIGHTING MEASURES**

**NFPA code:** **Flammability:** 0, **Health:** 0, **Reactivity:** 1, **Special:** 0.

**Flash point:** Not Combustible

**Unusual Fire Hazard / Extinguishing Media:** Product will react with water generating heat. If contact with water is unavoidable, use sufficient water to dissipate any excessive heat buildup.

**Hazardous Decomposition Products:** None

**Firefighting Instructions:** Firefighters should wear NIOSH-approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

#### **SECTION 6. ACCIDENTAL RELEASE MEASURES**

**Spill procedures:**Carefully, clean up and place material into a suitable container, being careful to avoid creating excessive dust from dried product. If conditions warrant, clean up personnel should wear approved respiratory protection, gloves, and goggles to prevent irritation from contact and/or inhalation.

#### **SECTION 7. HANDLING AND STORAGE**

**Storage:**Store in dry, protected storage. Do not allow water to get inside containers; reaction with water will cause product to swell, generate heat, and burst its container. Exposed, unprotected magnesium oxide will absorb moisture and carbon dioxide from the air. Minimize dust generation during material handling and transfer.

**SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION**

**Engineering controls:** Provide sufficient ventilation, in both volume and air flow patterns to control mist/dust concentrations below allowable exposure limits.

**Personal protective equipment:** The use of eye protection, gloves and long sleeve clothing is recommended.

**Respiration protection:** For dust concentrations above allowable nuisance particulates limit provide employee with NIOSH/MSHA approved particulate dust respirator in accordance with requirements of 29 CFR 1910.134.

**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES**

**Appearance:** The white, free flowing powder; odorless.

**Boiling Point:** Not Applicable

**Specific Gravity (g/cc):** 3.56

**Melting Point:** >3800°F (>2100°C)

**Bulk Density (lbs./cu.ft.):** 22

**Water Solubility:** Slight <1%

**% Volatile by volume:** 0

**pH (10% aqueous slurry):** 10-11

**Evaporation rate:** Not Applicable

**SECTION 10. STABILITY AND REACTIVITY**

**Hazardous Polymerization:** Will not occur

**Chemical Incompatibilities:** Magnesium oxide is soluble in aqueous acids generating heat and steam; violent reaction or ignition with interhalogens (e.g., bromine pentafluoride; chlorine trifluoride). Incandescent reaction with phosphorus pentachloride. Will react with water generating some heat.

**Hazardous Decomposition Products:** None

**SECTION 11. TOXICOLOGICAL INFORMATION**

**Magnesium Oxide** CAS #1309-48-4 Toxic and Hazard Review: low toxicity - a nutrient and/or dietary supplement food additive.

THERAP CAT: antacid. (Sax) an experimental tumorigen. Inhalation of fume (not MgO dust particular) produced upon decomposition of magnesium compounds can produce a febrile reaction and leukocytosis in humans.

TOXICITY DATA: ihl-hmn TCLo:400mg/m<sup>3</sup>; itr-ham TDLo:480 mg/kg/30w-l:ETA.

**SECTION 12. ECOLOGICAL INFORMATION**

**Ecotoxicological / Chemical Fate Information:**

No data available on any adverse effects of this material on the environment.

**SECTION 13. DISPOSAL INFORMATION**

**Waste Management/Disposal:** This product does not exhibit any characteristics of a hazardous waste. The product is suitable for landfill disposal. Follow all applicable federal, state and local regulations for safe disposal.

**SECTION 14. TRANSPORT INFORMATION**

**US Department of Transportation:** Not regulated by DOT as a hazardous material. No hazard class, no label or placard required, no UN or NA number assigned.

**Canadian TDG Hazard Class & Pin:** Not regulated.

**SECTION 15. REGULATORY INFORMATION**

**SARA TITLE III:** This product does not contain any substances reportable under Sections 302, 304 or 313. Sections 311 and 312 do apply. (Routine Reporting and Chemical Inventories)

**TSCA:** All substances in this product are listed in the Chemical Substance Inventory of the Toxic Substances Control Act.

**SECTION 16. OTHER INFORMATION**

**ACRONYMS AND REFERENCES USED IN PREPARATION OF MSDS':**

ACGIH:	American Conference of Governmental Industrial Hygienists
CAS#:	CAS Registration Number is an assigned number to identify a material. CAS stands for Chemical Abstracts Service.
CERCLA:	Comprehensive Environmental Response, Compensation & Liability Act
EPCRA:	Emergency Planning and Community Right-to-Know Act of 1986
HMISTM:	Hazardous Materials Identification System (National Paint & Coatings Association)
IARC:	International Agency for Research on Cancer
MSHA:	Mine Safety and Health Administration
mg/m <sup>3</sup> :	Milligrams per cubic meter
NIOSH:	National Institute for Occupational Safety and Health
NFPA:	National Fire Protection Association
NTP:	National Toxicology Program
OSHA:	Occupational Safety and Health Administration
PEL:	Permissible Exposure Limit (OSHA)
REL:	Recommended Exposure Limit (OSHA)
SARA:	Superfund Amendments and Reauthorization Act
TITLE III:	Emergency Planning and Community Right-to-Know Act
Section 302:	Extremely Hazardous Substances
Section 304:	Emergency Release
Section 311:	<i>Community Right-to-Know</i> , MSDSs or List of Chemicals
Section 312:	<i>Community Right-to-Know</i> , Inventory and Location, (Tier I/II)
Section 313:	Toxic Chemicals, Toxic Chemical Release Reporting, Form R
TLV:	Threshold Limit Values (ACGIH)
TWA:	Time Weighted Average
29CFR1910.134:	OSHA Respiratory Protection Standard

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Sax, N. Irving and Lewis, R.J. Hawley's Condensed Chemical Dictionary, Eleventh Ed., Van Nostrand Reinhold Co., Inc., NY  
Manufacturers / Suppliers, Material Safety Data Sheets on Raw Materials Used  
American National Standard for Hazardous Industrial Chemicals - Material Safety Data Sheets - Preparation, American National Standards Institute, Inc., 11 West 42<sup>nd</sup> St, New York, NY 10036.

Prepared/revised: Mark A. Shand

January 20, 2006

Although reasonable care has been taken in the preparation of the information contained herein, Premier Chemicals extends no warranties, makes no representation and assumes no responsibility as to the accuracy or suitability of such information for application to purchaser's intended purposes or for consequences of its use.



## OMRI Listed®

The following product is OMRI Listed. It may be used in certified organic production or food processing and handling according to the USDA National Organic Program Rule.

**Product**  
Epsom Salt

**Company**  
Giles Chemical, a Division of Premier Magnesia, LLC  
Mr. Lee Cagle  
P.O. Box 360 or 102 Commerce Street  
Waynesville, NC 28786

**Status**  
Allowed with Restrictions

**Category**  
Magnesium Sulfate – synthetic

**Issue Date**  
27-Apr-07

**Product number**  
gcc-0769

**Class**  
Crop Fertilizers and Soil Amendments

**Expiration Date**  
01-Jun-2013

### Restrictions

May be used as a plant or soil amendment only with a documented soil deficiency for magnesium.

*Peggy Mears*

Executive Director

Product review is conducted according to the policies in the current OMRI Policy Manual and based on the standards in the current OMRI Standards Manual. To verify the current status of this or any OMRI Listed product, view the most current version of the OMRI Products List at [www.omri.org](http://www.omri.org). OMRI listing is not equivalent to organic certification and is not a product endorsement. It cannot be construed as such. Final decisions on the acceptability of a product for use in a certified organic system are the responsibility of a USDA accredited certification agent. It is the operator's responsibility to properly use the product, including following any restrictions.

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OMRI Form 10-3-19-2013 04761213

# Attachment # 5 - Giles Chemicals CaSO<sub>4</sub> Technical Information Sheet



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**SPECIFICATIONS FOR  
MAGNESIUM SULFATE CRYSTALS,  
TECH  
October 24, 2008**

## Characteristics:

1. The material shall be colorless, solid at ambient temperatures, formed in small needle-like rhombic crystals and free of solid or fibrous foreign matter that will require dissolved material to be filtered before being used.
2. During normal storage periods, up to six months, the material shall be free flowing when emptied from its' shipping container. It shall not be subject to caking or bridging.

## Properties:

### CHEMICAL

MgSO <sub>4</sub> (as MgSO <sub>4</sub> · 7H <sub>2</sub> O), minimum %	99.00
MgSO <sub>4</sub> , minimum %	48.00
MgO, maximum %	00.10
Chlorides (as Cl) , maximum %	00.06
Sodium Salts (as Na) , maximum, ppm	25
Potassium Salts (as K) , maximum, ppm	25
Calcium Salts (as Ca) , maximum, ppm	25
Total Heavy Metals, maximum, ppm	10

### PHYSICAL

Color	Colorless
Crystal Form	Rhombic (monoclinic)
Density, Bulk (approximate) lb/ft <sup>3</sup>	65

## Quality Assurance Provision:

### GENERAL

The material specified herein shall be manufactured using acceptable industrial practices.

The material shall be guaranteed to meet chemical and physical properties specified herein.

### RESPONSIBILITY FOR TESTS & INSPECTIONS

Unless otherwise specified by purchaser, the supplier is responsible for providing a lot analysis of the material. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory. Analysis are available for each lot at an additional charge.

## Packaging & Shipping

### PACKAGING

Shall be accomplished in accordance with acceptable commercial practices for domestic or foreign shipments unless otherwise indicated by the purchaser. It shall be the vendor's responsibility to determine that packaging, as done, is adequate to assure that all material shall arrive at destination in an uncontaminated condition and ready for intended use.

### SHIPPING

Shall be accomplished in accordance with acceptable commercial practices for domestic or foreign shipment for this type of product unless otherwise indicated by the purchaser.

## Characteristics

## Discussion

EPSOM SALT is one of the most common forms of magnesium sulfate. EPSOM SALT is a hydrated salt with seven molecules of water, so caking or bridging should not be a significant problem. Care should be taken, however, to protect the material if it is stored in the granular form for long periods of time. EPSOM SALT is readily soluble in water and will yield a saturated 24.5 percent solution of magnesium sulfate at storage temperatures of 66 – 75 degrees F.

*PRODUCERS OF MAGNESIUM SULFATE SINCE 1950*

## Attachment #6 - Benefits of Humic Acids, Fulvic Acids and Humic Substances

### A Partial Bibliography of Humic Literature

#### ■ Recent Field Trials

- A randomized complete block replicated green house and field experiment on grassland pasture, potatoes, and maize showed that the application of liquid and dry humic substances had an overall positive effect on crop yield (Verlinden et al, 2009). The formal meta-analysis revealed an increase in nitrogen, phosphorus, potassium and magnesium in all of the crops, demonstrating a more efficient use of fertilizers. There was a substantial increase in grass production for the treated plants when subject to heat and water stress (drought).
- Application rate of 60 mg of humic acid per kilogram of soil generated the largest increase in height, weight and nutrient uptake in wheat grown on the soils when compared to applications of 30 and 90 mg/kg. The humic acid application significantly improved soil potassium, phosphorus and nitrate concentrations in both calcareous and non-calcareous soils (Tahir et al, 2011).
- Brownell et al (1987) reported average yield increases of 10.5% and 11.2% in replicated field trials for tomatoes and cotton respectively, and an average 25% increase in grape production on unreplicated large scale field trials of differing grape varieties in different vineyards.
- Fernandez-Escobar (1996) studied the effect of a potassium hydroxide extract of Leonardite containing humic acids and fulvic acids on olive trees. Although there was clearly an increase in vegetative growth and enhanced uptake of minerals, there was no statistically relevant effect on yield.
- A field study demonstrated how the combination of dry calcium with oxidized lignite (Leonardite) combination applied to alfalfa performed as well as the combination of calcium chloride and EDTA, a popular synthetic chelating agent (Pare', et al, 2001).
- After a thorough review of the literature and performing numerous experiments, Chen et al (2004a) concluded that humic substances at an application rate of 67.5 kg ha<sup>-1</sup> (59.4 lb a<sup>-1</sup>) and foliar application of humic and fulvic acids at 375 g ha<sup>-1</sup> will affect plant growth.
- The addition of humic acids with phosphate fertilizer was studied in a greenhouse trial and then confirmed by field trials on an alkaline soil. Water soluble phosphate was significantly increased in the alkaline soil, increasing the uptake of phosphorus and increasing yield by 25% (Wang et al, 1995).
- According to results of one study, (statistically significant, P< 0.05) humic acid treatments raised the yields and height of millet (Saruhan, Kuvuran, and Babat, 2011).
- Potassium management using humic substances is more effective when K<sup>+</sup> soil concentration is low (Pinton et al, 1997), which is typical in soils, suggesting that humic substance stimulation of K<sup>+</sup> influx into plant roots is more effective in low-input agricultural systems that utilize low soil concentrations of dissolved nutrients.
- Humic acids extracted from peat and Leonardite were applied to tomato plants by Adani et al (1998). Both sources of humic acids increased the uptake of nutrients. The peat extract stimulated root growth only, whereas the Leonardite humic acid extract improved both root and shoot growth in addition to improving the uptake of nitrogen, phosphorus, and especially iron. The improved iron uptake in the tomato plants was attributed to the reduction of iron from Fe<sup>3+</sup> to Fe<sup>2+</sup> by the humic substances.

#### ■ Nitrogen Management

- Humic acids may improve urea nitrogen use efficiency as well as reducing environmental pollution by increasing soil exchangeable NH<sub>4</sub><sup>+</sup> and available NO<sub>3</sub><sup>-</sup> while retaining more nitrogen in the soil (Yusuff et al 2009).
- In their natural state, humic substances contain anywhere from 1% to 5% nitrogen (Stevenson, 1994). Depending on the form of fertilizer applied, nitrogen may become a structural component of humic substances as a stable organic material, preventing it from leaching through the soil. (Haworth, 1971; Stevenson, 1982; Haynes and Swift, 1990; Kelly and Stevenson, 1996)
- Humic substances have the potential to reduce nitrogen application because of their ability to stimulate soil nitrifying bacteria (Vallini et al, 1997).
-

## Attachment # 6 - Benefits of Humic Acids, Fulvic Acids and Humic Substances (cont't)

- The importance of humic substances on the fertility of soils and the stabilization of nitrogen has been well documented (Thorn, 2000; Kelly and Stevenson, 1994; Nardi, et al, 1996).
  - If there are sufficient humic substances present, up to 35% of the soluble nitrogen applied to soils as fertilizers can be retained in the soil in organic forms at the end of the first growing season (Stevenson and Xin-Tao He, 1990), thus converting the N to a stable, yet bioavailable form.
  - Because of their ability to stabilize nitrogen, humic substances have become the most commonly used organic materials in golf course turf management (Clapp et al, 1998).
  - After 45 years of research, C. Edward Clapp of the USDA-ARS, Department of Soil, Water & Climate in Minneapolis, Minnesota, has recommended the use of humic substances to prevent nitrogen leaching on golf courses (Clapp, 2001).
- Phosphorus Management
    - Humic substances have the ability to stabilize phosphorus fertilizers (Day, et al, 2000)
    - The ability of humic substances to solubilize and complex with natural minerals, such as rock phosphates, is well documented (Chen, et al, 1999). The solubilization of is primarily through interactions with soil microbes (Burdick, 1965; Banfield and Hamers, 1997; Schnitzer, 1986; Martinez et al, 1984; Tan, 1986).
    - Humic substances keep minerals in soil solution keeping them from precipitating with soil iron and aluminum through complexation reactions (Tan, 1986; Banfield and Hamers, 1997; Schnitzer, 1986), and interactions with other common soil elements, especially the lanthanide elements, which are effective in stabilizing phosphorus in soil systems (Banfield and Hamers, 1997).
    - Both humic acid and fulvic acid fractions are capable of solubilizing immobilized aluminum and iron phosphates into bioavailable forms of phosphates (Lobartini et al, 1998; Levesque and Schnitzer, 1967; Weir and Soper, 1963).
  - Toxins
    - Humic substances remove toxic metals from the surrounding environment by forming insoluble aggregated spheres around them (Liu and Huang, 1999), thus detoxifying arsenic, cadmium, and aluminum into forms that are not biologically available.
    - Humic substances are the major components of soil organic matter that deactivate both metal and xenobiotic (pesticide) toxins. As a comprehensive reference on the detoxification of contaminants, see Clapp et al (2001a).
    - Over 50% of the composition of natural humic substances consists of the humin fraction, which has been described as being primarily responsible for the ability of humic substances to bind toxins (Rice, 2001, Clapp et al, 2001a).
  - Soil Physico-Chemical Interactions
    - Soil nutrients are retained partly due to soil stabilization by humic substances (Piccolo et al, 1999)
    - Humic substances can improve water holding capacity for better drought resistance and reduction in water usage (Russo and Berlyn, 1990)
    - Good soil structure is influenced by humic substances participating in numerous bridging mechanisms, including water, aluminum, and calcium bridging (Tan, 2003, pp. 250-253.)
    - Humic substances are important components of soil redox systems, transferring, donating, accepting, and shuttling electrons (Tan, 2003, pp. 259-260; Jiang and Kappler, 2008).
  - Plant growth stimulants
    - A greenhouse study of soybean, peanut and clover treated with using humic acids extracted from soil increased dry matter production and the size of root nodulation (Tan and Tantiwiranond, 1983)

## Attachment # 6 - Benefits of Humic Acids, Fulvic Acids and Humic Substances (cont't)

- The stimulatory effects of humic substances has been conducted by the USDA-ARS soil lab in Minneapolis (Clapp et al, 2001; Chen et al, 2001; Chen et al, 1999, Chen et al, 2004) and worldwide (Karr, 2001)
- Stimulation of root growth is generally more apparent than stimulation of shoot growth. (Chen and Aviad, 1990; Nardi, et al, 1996; Abad et al, 1991)
- The addition of humic substances to soils, including calcareous soils, can stimulate growth beyond the effects of mineral nutrients alone (Chen, et al, 1999).
- Humic substances are active soil redox agents, making iron more plant and microbe available by reducing fixed soil iron (Fe<sup>3+</sup>) to bioavailable iron (Fe<sup>2+</sup>) (Rakshit et al, 2009)
- The hormone-like stimulatory effects of humic substances on plant growth has been attributed to the increased uptake of micronutrients (Chen et al, 2004a)
- The stimulatory effects of humic substances are non-hormonal when tested in nutrient solution (Chen et al, 1994; Clapp et al, 2001). However, there is also evidence that humic substances found in worm excreta have exchangeable auxin groups attached to them (Canellas et al, 2002)
  
- Microbial Stimulants
  - Humic substances enhance the uptake of minerals through the stimulation of microbiological activity. (Albuzio et al, 1994; Figliolia et al, 1994; Visser, 1985; Nardi, et al, 1996; Paciolla, et al, 1998; Day et al, 2000)
  - The addition of humic substances to soils at concentrations in the range of 10 – 30 mg L<sup>-1</sup> stimulate microbiological activity. Microbial stimulation is dependent upon soil type, greater in loam soils compared to sandy soils, and the concentration of fulvic acids and humic acids added to those soils (Visser, 1985).
  - Enzyme activity is preserved by humic substances, imparting a high degree of resistance to decomposition and denaturing, allowing enzymes to persist for many years in soils (Jackson, 1995).
  - Humic substances are generally regarded in the scientific community as microbiological stimulants and powerful detoxifying agents (Hudák et al, 1997; Perminova et al, 2001).
  - Humic substances are responsible for mediating all soil geomicrobiological and geochemical interactions by providing the media on which complex interactions among soil metals, organic substances and microbes may occur (Huang, 2002).
  - Three commercial soil amendments derived from humified compost, oxidized lignite, and peat, all having varying concentrations of fulvic and humic acids, were applied to an aridisol soil to study their effects on nitrogen mineralization, dehydrogenase, and alkaline phosphatase activities as indicators of microbial activity. The effects varied according to the amendment used (Lizarazo et al, 2005).
  - Humic substances are capable of stabilizing the metabolic activity of bacterial strains used in bioremediation of contaminants, thus increasing their effectiveness (Hwang and Tate, 1997)
  - Carbon and nitrogen cycling primarily involves microorganisms, having both a direct and indirect effects on nutrient cycling and environmental quality (Muller-Wegener, 1988).
  
- Mechanisms
  - Early researchers did not know why humic acids had a stimulatory effect on plant growth. Some thought that humic acids extracted from lignite coals contained hormones because of the low doses needed to produce a positive response (Dekock and Sthmecki, 1954).
  - Chelation and complexation by humic substances keeps plant nutrients in soil solutions (Tan, 1986; Chen, et al, 1999; Clapp, et al, 1998).
  - The reactivity of humic substances with mineral surfaces was reviewed by Bailey et al (2001) using computational chemistry, scanning probe microscopy and virtual reality for predicting the chemical reactivity of humic substances with xenobiotics (toxins) from the perspective of surface reactivity.
  - Natural humic substances may be complex “supermixture” of high and low molecular weight humic substances (MacCarthy, 2001). The higher molecular weight components (humic acids) also engage in

## Attachment # 6 - Benefits of Humic Acids, Fulvic Acids and Humic Substances (cont't)

- solubilizing minerals and have a high capacity for stimulating biological activity. The chemical reactivity and chelating ability of humic acids is equal to or greater than fulvic acids (Tan, 2003).
- Humic substances participate in the rhizosphere interactions coating soil clays as part of soil genesis, weathering, and soil aggregate formation (McKeague et al, 1986).
- Dissolution of insoluble soil minerals by fulvic acids occurs in the presence of microbes at extremely dilute solution concentrations, with iron-containing minerals being the most susceptible to attack by fulvic acids (Schnitzer, 1986).
- Tombacz and Rice (1999) attributed the release of soluble nutrients from minerals to the membrane-like layers of humic substances that form on the mineral surfaces. Humic substances form micelles (Piccolo et al, 1996; Sutton and Sposito, 2005), which are aggregates of amphiphilic molecules having hydrophilic (polar) ends arranged towards the soil solution while their hydrophobic ends arranged towards the center of the aggregate away from the outer solution. This explains, in part, their high surface activity and strong association with soil solution cations (Yates and von Wandruszka, 2005).
- Wang et al, 1995 reported increased uptake of phosphorus and improved yield in a greenhouse and field study on wheat grown on an alkaline soil. They attributed the result to the ability of applied humic acids to prevent fixation of phosphates, thus maintaining phosphorus in soil solution.
- Aguirre et al, (2009) attributed the increase in uptake of iron on the transcriptional regulation of the principal molecular agents involved in iron assimilation. They quantified the effects of a purified humic acid on the genetic encoding for Fe(III) chelate-reductase and encoding for plasma membrane H<sup>+</sup> ATPase. The effects on the enzyme activity level were associated with the presence of a humic acid with physicochemical characteristics within the range of an IHSS standard Leonardite humic acid.
- The stimulation of root growth has been studied in the context of overall transcriptomic results, where some researchers have concluded that HS exert their function on plant physiology and development, in part by means of their well demonstrated auxin activity, but also by interacting with nutrients and interfering with the stress response signaling. Their physiological effects seem to target vesicle trafficking, transport mechanisms, gene transcription, protein regulation and Ca<sup>2+</sup> signaling (Trevisan et al, 2011).

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**Attachment # 6 - Benefits of Humic Acids, Fulvic Acids and Humic Substances (cont't)**

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## Attachment # 7 - US FDA GRAS Opinion

### Select Committee on GRAS Substances (SCOGS) Opinion:

#### Magnesium oxide

- SCOGS-Report Number: 60\*
- Type Of Conclusion: 1
- ID Code: 1309-48-4
- Year: 1979
- 21 CFR Section: 184.1431

#### SCOGS Opinion:

Magnesium is a dietary essential. It is involved in myriad metabolic reactions and is necessary for the activity of many intracellular enzymes. Also, with certain other cations, it is important in electrolyte balance. Magnesium is present in fruits, vegetables, grains, milk, meat and fish and the natural content of these foods is the major source of the current dietary intake. The Food and Nutrition Board, NRC, has recommended that cereal grain products be fortified with magnesium in view of potential risk of deficiency among significant segments of the population. The usual adult intake is about 300mg or less per day from all sources and the contribution of food additives to total magnesium intake is very small. The administration of magnesium sulfate in very high doses to humans occasionally has resulted in severe and even fatal episodes, especially in the presence of pre-existing disease. These occurrences should not be prejudicial to the use of magnesium salts as foods ingredients since the dosages given were orders of magnitude greater than the daily intake of magnesium added to food. While chronic toxicity data are lacking, the status of magnesium as a ubiquitous and essential dietary ingredient for the maintenance of homeostatic and bioenergetic mechanisms leads to the opinion that none of the available evidence suggest any probable hazard when any of the GRAS compounds of magnesium is used as a food ingredient. In view of the foregoing, The Select Committee concludes that: There is no evidence in the available information on magnesium carbonate, magnesium chloride, magnesium sulfate, magnesium hydroxide, magnesium oxide, magnesium stearate, dibasic magnesium phosphate and tribasic magnesium phosphate that demonstrates, or suggests reasonable grounds to suspect, a hazard to the public when they are used at levels that are now current and in the manner now practiced, or which might reasonably be expected in the future.

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\* Complete reports containing details of the safety studies that formed the basis of the opinions and conclusions and are available from the [National Technical Information Service](#)<sup>2</sup> (NTIS), 5285 Port Royal Road, Springfield, VA 22161 (703) 605-6000.

Page Last Updated: 08/16/2011

U.S. Food and Drug Administration  
10903 New Hampshire Avenue  
Silver Spring, MD 20993  
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1. </Food/FoodIngredientsPackaging/GenerallyRecognizedasSafeGRAS/GRASSubstancesSCOGSDatabase/ucm2006852.htm>
2. <http://www.ntis.gov/>

## Attachment #8 - Joint FAO/WHO Summary of Magnesium Oxide Review

### Summary of Evaluations Performed by the Joint FAO/WHO Expert Committee on Food Additives

#### **MAGNESIUM OXIDE**

<b>INS:</b>	530
<b>Chemical names:</b>	MAGNESIUM OXIDE
<b>Functional class:</b>	ANTICAKING AGENT; NEUTRALIZING AGENT
<b>Latest evaluation:</b>	1965
<b>ADI:</b>	NOT LIMITED
<b>Report:</b>	NMRS 40/TRS 339-JECFA 9/16
<b>Specifications:</b>	COMPENDIUM ADDENDUM 9/FNP 52 Add.9/192 (METALS LIMITS) (2001)
<b>Tox monograph:</b>	FAS 67.29/NMRS 40A,B,C-JECFA 9/159
<b>Previous status:</b>	1973, FNP 4-JECFA 17/81. R; COMPENDIUM/889 1965, NMRS 40/TRS 339-JECFA 9/16, FAS 67.29/NMRS 40A,B,C-JECFA 9/159, FAS 67.29/NMRS 40A,B,C-JECFA 9/159. ADI NOT LIMITED. NL. N

Attachment #9 – Generalized Flow Diagram of Seawater/Brine Precipitation Process

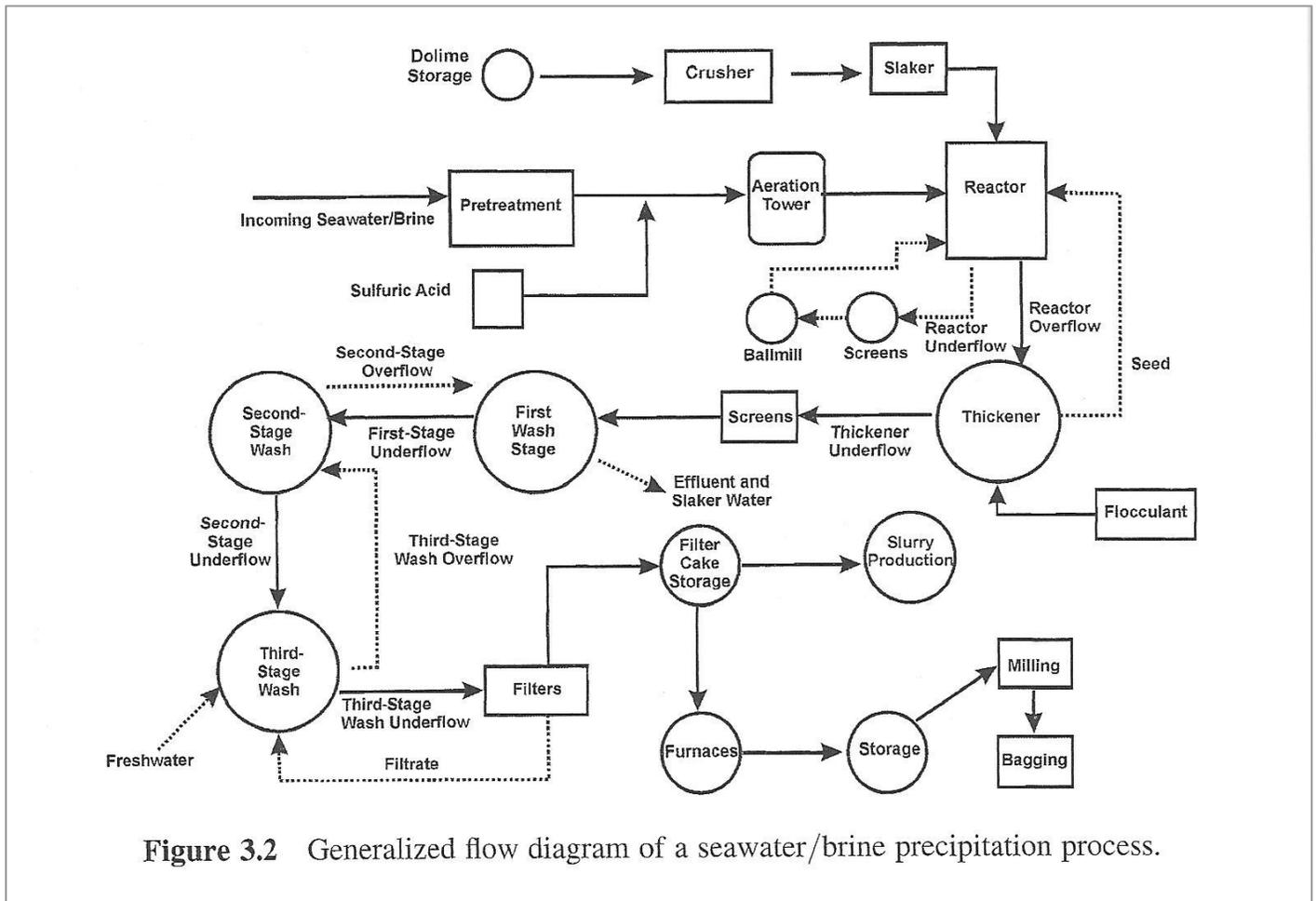
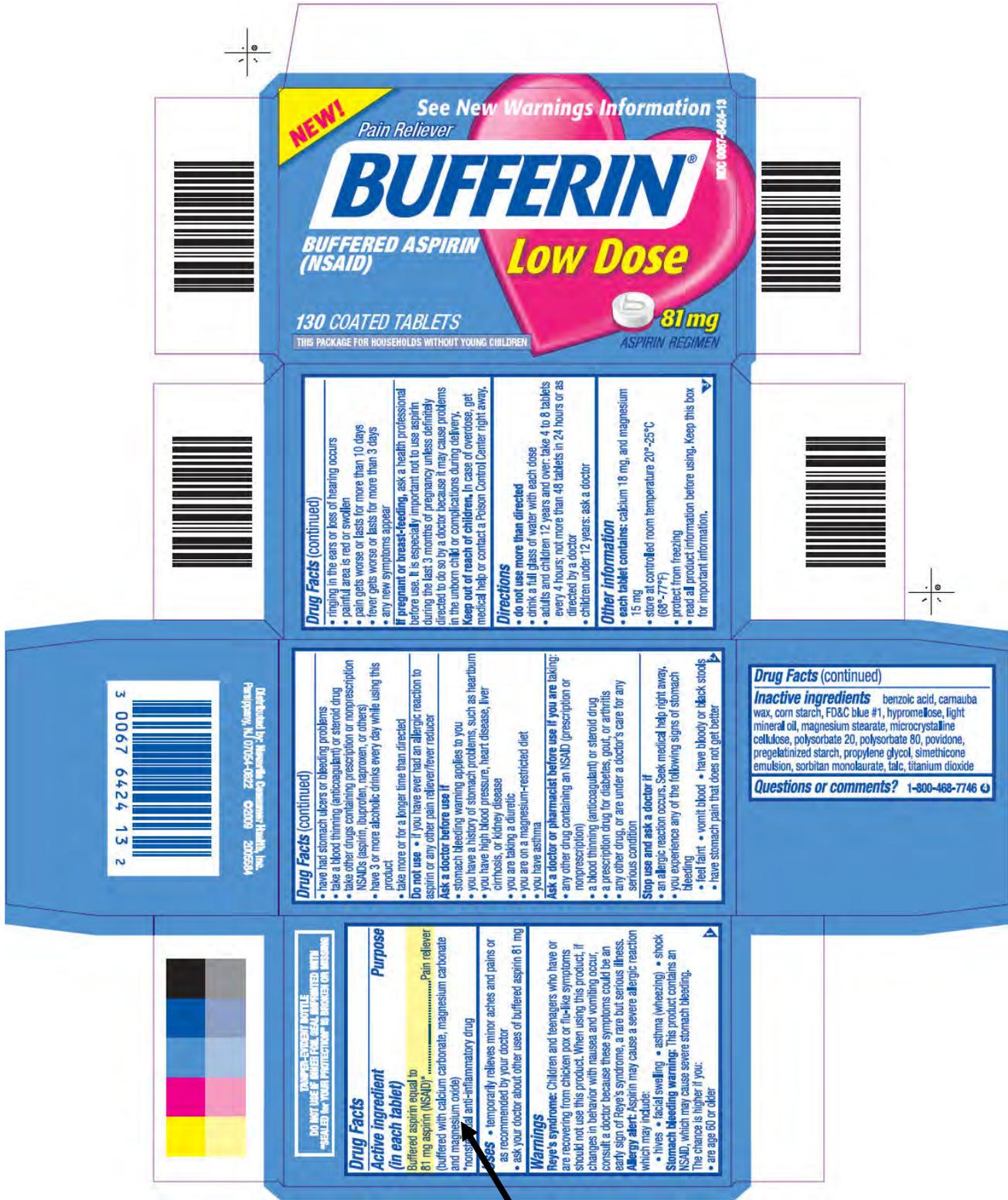


Figure 3.2 Generalized flow diagram of a seawater/brine precipitation process.

Shand, Mark A., 2006. The Chemistry and Technology of Magnesia, Wiley Interscience, page 46.



**NEW!** See New Warnings Information  
 Pain Reliever  
**BUFFERIN**<sup>®</sup>  
 BUFFERS ASPIRIN (NSAID) **Low Dose**  
 130 COATED TABLETS **81mg**  
 THIS PACKAGE FOR HOUSEHOLDS WITHOUT YOUNG CHILDREN ASPIRIN REGIMEN

**Drug Facts (continued)**

- ringing in the ears or loss of hearing occurs
- painful area is red or swollen
- pain gets worse or lasts for more than 10 days
- fever gets worse or lasts for more than 3 days
- any new symptoms appear

**If pregnant or breast-feeding**, ask a health professional before use. It is especially important not to use aspirin during the last 3 months of pregnancy unless definitely directed to do so by a doctor because it may cause problems in the unborn child or complications during delivery. **Keep out of reach of children.** In case of overdose, get medical help or contact a Poison Control Center right away.

**Directions**

- do not use more than directed
- drink a full glass of water with each dose
- adults and children 12 years and over: take 4 to 8 tablets every 4 hours; not more than 48 tablets in 24 hours or as directed by a doctor
- children under 12 years: ask a doctor

**Other information**

- each tablet contains: calcium 18 mg, and magnesium 15 mg
- store at controlled room temperature 20°-25°C (68°-77°F)
- protect from freezing
- read all product information before using. Keep this box for important information.

**Drug Facts (continued)**

- have had stomach ulcers or bleeding problems
- take a blood thinning (anticoagulant) or steroid drug
- take other drugs containing prescription or nonprescription NSAIDs (aspirin, ibuprofen, naproxen, or others)
- have 3 or more alcoholic drinks every day while using this product
- take more or for a longer time than directed

**Do not use** • if you have ever had an allergic reaction to aspirin or any other pain reliever/fever reducer

**Ask a doctor before use if**

- stomach bleeding warning applies to you
- you have a history of stomach problems, such as heartburn, ulcers, or kidney disease
- you have high blood pressure, heart disease, liver cirrhosis, or kidney disease
- you are taking a diuretic
- you are on a magnesium-restricted diet
- you have asthma

**Ask a doctor or pharmacist before use if you are taking:**

- any other drug containing an NSAID (prescription or nonprescription)
- a blood thinning (anticoagulant) or steroid drug
- a prescription drug for diabetes, gout, or arthritis
- any other drug, or are under a doctor's care for any serious condition

**Stop use and ask a doctor if**

- an allergic reaction occurs. Seek medical help right away.
- you experience any of the following signs of stomach bleeding
- feel faint
- vomit blood
- have bloody or black stools
- have stomach pain that does not get better

**Drug Facts (continued)**

**Inactive ingredients** benzoic acid, carnauba wax, corn starch, FD&C blue #1, hypromellose, light mineral oil, magnesium stearate, microcrystalline cellulose, polysorbate 20, polysorbate 80, povidone, pregelatinized starch, propylene glycol, simethicone emulsion, sorbitan monolaurate, talc, titanium dioxide

**Questions or comments?** 1-800-468-7746

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**Drug Facts**

**Active ingredient (in each tablet)**  
 Buffered aspirin equal to 81 mg aspirin (NSAID) ..... Pain reliever and magnesium carbonate, magnesium carbonate and magnesium oxide  
 \*nonsteroidal anti-inflammatory drug

**Purpose**  
 • temporarily relieves minor aches and pains or as recommended by your doctor  
 • ask your doctor about other uses of buffered aspirin 81 mg

**Warnings**  
**Reye's syndrome:** Children and teenagers who have or are recovering from chicken pox or flu-like symptoms should not use this product. When using this product, if changes in behavior with nausea and vomiting occur, consult a doctor because these symptoms could be an early sign of Reye's syndrome, a rare but serious illness. **Allergy alert:** Aspirin may cause a severe allergic reaction which may include:  
 • hives • facial swelling • asthma (wheezing) • shock  
**Stomach bleeding warning:** This product contains an NSAID, which may cause severe stomach bleeding. The chance is higher if you:  
 • are age 60 or older