November 6, 2014

National List Manager
USDA/AMS/NOP, Standards Division
1400 Independence Ave. SW
Room 2648-So., Ag Stop 0268
Washington, DC 20250-0268

Re: Petition to remove Lignin Sulfonate - As floating agents in postharvest handling from the National List as a synthetic substance allowed for use in organic crop production under §205.601(l)(1).

Dear National List Manager:

Please accept the attached petition to remove Lignin Sulfonate as floating agents in postharvest handling from the National List as a synthetic substance allowed for use in organic crop production under §205.601(l)(1) based on a lack of essentiality.

Lignin Sulfonate was placed on the original National List and was retained during Sunset Reviews in 2006 and 2011. Prior to its original listing, the 1995 TAP review suggested that Lignin Sulfonate was the “best product for pear floatation available.” While this may have been true at the time, in today’s practices it is not widely used, if at all.

As part of a recent outreach project, the Organic Trade Association conducted a poll of all certified organic pear packing facilities in the U.S. The poll was based upon the NOP list of certified handlers that are certified to pack organic pears and cross referenced with the organic shipper’s list from Pear Bureau NW. Each operation was accounted for either through direct contact by OTA personnel or consult with their ACAs that referenced approved OSPs on file. This research showed that none of these handlers are using lignin sulfonate. They have all either switched to floatless systems that do not use floating agents or, when necessary, are using one of the alternative materials on the National List that may be used as a floating agent (i.e., sodium silicate, sodium carbonate, potassium carbonate).

This suggests that while floating agents may still be used by some organic pear packers, this use of lignin sulfonate is no longer essential to organic production. It is on this basis that OTA is filing this petition to remove lignin sulfonate from 205.601(l)(1) as a floating agent in post-harvest handling.

If you need any additional information, please contact me.

Respectfully,

Nathaniel Lewis
Senior Crops and Livestock Specialist
Organic Trade Association (OTA)

cc: Laura Batcha, Executive Director / CEO, OTA
Petition to Remove Lignin Sulfonate at 7 CFR 205.601(l)

Item A

This petition seeks the removal of LIGNIN SULFONATE - As floating agents in postharvest handling from the National List as a synthetic substance allowed for use in organic crop production under §205.601(l)(1) based on a lack of essentiality.

Note that this petition only addresses the use of lignin sulfonate as a floating agent in postharvest handling as listed in §205.601(l)(1), not as a dust suppressant or chelating agent as listed at §205.601(j)(4) or as an inert ingredient in pesticide products as listed at §205.601(m)(1).

Item B

1. The substance’s chemical or material common name.

Lignin sulfonate

Other chemical names for lignin sulfonate are:
- Lignosulfonate
- Lignosulfuric acid
- Lignosulfonic acid
- LST 7
- Ligninsulonic acid
- Poly(lignosulfonic acid)
- Sulfite lignin

Commonly used salts of lignin sulfonate are:
- Sodium lignosulfonate
- Magnesium lignosulfonate
- Ammonium lignosulfonate
- Calcium lignosulfonate

2. The petitioner’s name, address and telephone number and other contact information.

The Organic Trade Association
The Hall of the States
444 N. Capitol St. NW. Suite 445A
Washington D.C. 20001
Contact Person: Nathaniel Lewis
Title: Senior Crops and Livestock Specialist
Phone: (360) 388-6422 alt. (802) 275-3800
Email: nlewis@ota.com
3. The current use of the substance.

The only use of Lignin Sulfonate addressed by this petition to remove is as a floating agent in postharvest handling of products (e.g., pears) (7 CFR 205.601(l)(1)).

Other current uses not applicable to this petition:
Lignin sulfonate is allowed for use in organic crop production as a plant or soil amendment as a dust suppressant and as a chelating agent (7 CFR 205.601(j)(4)).

Calcium lignosulfonate (CAS No. 8061-52-7) and sodium lignosulfonate (CAS No. 8061-51-6) may be used as inert ingredients in pesticide products. These inert ingredients are on EPA’s inert ingredients list (List 4B) and are therefore currently allowed for use as inert ingredients in pesticide products.

Even though it is not a “current” use, it should also be noted that there is a petition for the use of lignin sulfonate in aquatic plant production that is still pending. At the Spring 2014 NOSB meeting, it was referred back to Livestock Subcommittee until NOP issues a proposed rule on organic aquaculture standards and NOSB receives additional technical information as needed.


Lignin sulfonate is used as a floatation agent in post-harvest handling of pears and stone fruits (i.e., peaches, nectarines, and apricots). It is added to the float tanks used to remove fruit from the bins in which they are transported to the packing house. As each bin is completely submerged in the float tank, the fruit floats out, thereby eliminating any excessive physical contact which can damage the fruit. However, because pears and stone fruits have approximately the same or higher density as water, they do not float well enough to move out of the bins and through the dump tank. Therefore, some facilities historically added lignin sulfonate to the water in the tank to increase its specific gravity, thereby allowing the fruit to better float.

5. The source of the substance and manufacturing description.

For details on the manufacturing process, please refer to the Technical Evaluation Report prepared in 2011 for the NOSB (Appendix A).

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

Lignin sulfonate is currently included on the National List as a synthetic substance allowed for use in organic production (7 CFR 205.601). Lignin sulfonate may be used in organic crop production as a plant or soil amendment (dust suppressant or chelating agent) or a flotation agent in postharvest handling (see 7 CFR 205.601(j)(4) and 7 CFR 205.601(l)(1)). Please reference the Technical Advisory Panel Report.
Petition to Remove Lignin Sulfonate at 7 CFR 205.601(l)

prepared in 1995 (Appendix B), the Technical Evaluation Report prepared in 2011 (Appendix A) and the Formal Recommendation by the NOSB Crops Committee regarding its Sunset 2012 relisting (Appendix C).

Calcium lignosulfonate (CAS No. 8061-52-7) and sodium lignosulfonate (CAS No. 8061-51-6) may be used as inert ingredients in pesticide products. These inert ingredients are on EPA’s inert ingredients list (List 4B) which, in combination with List 4A, was used as a reference for allowed inert ingredients in organic pesticide products.

Some international organizations allow the use of lignin sulfonate in organic food production. The Canadian General Standards Board allows the use of lignin sulfonate as a dust suppressant, formulant ingredient, and chelating agent (Canadian General Standards Board, 2009). The International Federation of Organic Agriculture Movements (IFOAM) includes calcium lignosulfonate on its —Indicative List of Substances for Organic Production and Processing. No other lignin sulfonates are included (IFOAM, 2008). As of 2009, calcium lignosulfonate is allowed by the CODEX Alimentarius Commission as a food additive, and the compound has been assigned INS Number 1522 (Codex Alimentarius Commission, 2010).

Until 2008, lignin sulfonate was not allowed to be used in the production or handling of certified organic products exported to Japan from the United States. In 2008, the Ministry of Agriculture, Forestry, and Fisheries (MAFF) in Japan lifted the ban on lignin sulfonate used as a dust suppressant or chelating agent in organic crop inputs but maintained the ban on lignin sulfonate used in post-harvest handling (i.e. flotation agent for pears and stone fruit). At that time, products exported to Japan were required to have verification that they were handled without lignin sulfonate, be accompanied by an export certificate, and be imported by a JAS- certified importer (USDA, 2009). The restriction on lignin sulfonate as a handling material for organic products exported to Japan was dropped when US/Japan Equivalency Arrangement went into effect (January 1, 2014). Lignin sulfonate is not specifically discussed by the European Union Regulations.

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

Food and Drug Administration
Lignin sulfonate and its salts are cited in several FDA regulations in Title 21, Code of Federal Regulations including §573.600 (Food Additives Permitted in Feed and Drinking Water of Animals), §176.210 (Indirect Food Additives; Defoaming agents used in the manufacture of paper and paperboard), §176.170 (Indirect Food Additives; Components of paper and paperboard in contact with aqueous and fatty foods), and §177.1210 (Indirect Food Additives; Closures with sealing gaskets for food containers).

Environmental Protection Agency
According to 40 CFR §180.900, “An exemption from a tolerance shall be granted when it appears that the total quantity of the pesticide chemical in or on all raw agricultural commodities for which it is useful under conditions of use currently prevailing or proposed will involve no hazard to the public health.”
Petition to Remove Lignin Sulfonate at 7 CFR 205.601(l)

Lignin sulfonate and its salts are approved for Food and Nonfood Use and are exempted from the requirement of a tolerance when used in accordance with good agricultural practice as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest and to animals (40 CFR §180.910 and §180.930 respectively).

8. The Chemical Abstracts Service (CAS) number or other product numbers of the substance.

The CAS number for lignin sulfonate is 8062-15-5.

Other codes are:

- 705707 (USEPA PC Code [U.S. EPA 2010b])
- 160226 (EPA Reference ID)
- 705705, 705708–705714 (U.S. EPA PC Code [U.S. EPA, 2010b], various lignosulfonate salts)
- 1522 (CODEX Alimentarius Commission INS Number, calcium lignosulfonate)

The CAS numbers for commonly used salts of lignin sulfonate are:

- 8061-51-6 (sodium lignosulfonate)
- 8061-54-9 (magnesium lignosulfonate)
- 8061-53-8 (ammonium lignosulfonate)
- 8061-52-7 (calcium lignosulfonate)

9a. The substance’s physical properties

Lignin sulfonate is a solid (commonly sold as a powder or in liquid suspension) that is brown and odorless. For more details on this substance’s physical properties, please refer to the Technical Evaluation Report prepared in 2011 for the NOSB (Appendix A).

9b. Chemical mode of action

(a) Chemical interactions with other substances, especially substances used in organic production:

With respect to its use as a floatation agent in the handling of fruit, lignin sulfonates are not compatible with chlorine compounds in the dump tank, since chlorine ions tend to become inactivated by binding with the large carbon-based lignin sulfonate molecules.

(b) Toxicity and environmental persistence:

Lignin sulfonate itself is generally considered to be of relatively low toxicity, except at high doses. However, due to its high biological oxygen demand (BOD) during breakdown in water, lignin sulfonate will remove dissolved oxygen from waterways in amounts that may be harmful to aquatic organisms, therefore care must be taken to ensure it is not discharged to waterways without proper pretreatment.
(c) **Environmental impacts from its use and/or manufacture:**

The dark brown color from the lignin sulfonate can interfere with UV disinfection systems, causing it to pass through wastewater treatment plants using these systems without being sufficiently treated. Wastewater containing lignin sulfonate discharged into water bodies may cause foaming and discoloration.

(d) **Effects on human health:**

The U.S. EPA issued an exemption from the requirement of a tolerance for lignin sulfonates when they are used as inert ingredients pre- and post-harvest in agricultural production. This exemption is based on the conclusion that there is a ‘…reasonable certainty that no harm will result…’ to the general public, infants, and children from aggregate exposures (includes all dietary, drinking water, and non-occupational exposures) to lignosulfonates.

(e) **Effects on soil organisms, crops, or livestock:**

With respect to lignin sulfonate’s usage as a floating agent in postharvest handling, there is no direct effect on soil organisms, crops, or livestock expected.

For more details on chemical modes of action listed in this section, please refer to the Technical Evaluation Report prepared in 2011 for the NOSB (Appendix A).

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.**

MSDSs for some of the trade name products listed in the Technical Evaluation Report prepared in 2011 for the NOSB are attached in Appendix D.

11. **Research information about the substance**

Approximately 85% of all pears (organic and conventional) come from the Pacific Northwest. The vast majority of the organic pears produced in the US come from Oregon and Washington. The rest are from California, and there are only two other US facilities that pack organic pears, one in Colorado and one in New Jersey.

As part of a recent outreach project, the Organic Trade Association conducted a poll of all certified organic pear packing facilities in the US. The poll was based upon the NOP list of certified handlers that are certified to pack organic pears and cross referenced with the organic shipper’s list from Pear Bureau NW. Each operation was accounted for either through direct contact by OTA personnel or consult with their ACAs that referenced approved OSPs on file. This research showed that none of these handlers are using lignin sulfonate. They have all either switched to floatless systems that do not use floating agents or, when necessary, are using one of the alternative materials on the National List that may be used as a floating agent (i.e., sodium silicate, sodium carbonate, potassium carbonate).
12. Petition Justification Statement

This petition requests the removal of lignin sulfonate as a floating agent in postharvest handling (§205.601(l)(1)) as it is no longer essential for organic production.

There are currently four substances on the National List that may be used to float organic pears in post-harvest handling:

- lignin sulfonate (§205.601(l)(1))
- sodium silicate (§205.601(l)(2))
- sodium carbonate (§205.605(a))
- potassium carbonate (§205.605(b))

Informal polling of certifiers and major pear packers currently certified to the USDA organic regulations suggest that organic pear packers whose equipment still require a floating agent use one of the alternative substances rather than lignin sulfonate due, in part, to the substance’s incompatibility with chlorine sanitizers.

Approximately twice as much lignin sulfonate as sodium silicate is needed to reach the same specific gravity. Lignin sulfonate is incompatible with chlorine sanitizers and reduces their disinfecting properties. Because lignin sulfonates make very dark solutions, they can interfere with UV disinfection systems and therefore may not be sent to wastewater treatment plants that use these systems.

As the pear industry modernizes its equipment, floating agents are becoming obsolete and new “floatless” packing lines are being installed. In outreach efforts to pear packing facilities that are on the NOP list of certified handlers that are certified to pack organic pears cross referenced with the organic shipper’s list from Pear Bureau NW, we found that many packers have upgraded their systems to use floatless dump tanks, therefore no specific gravity enhancing chemicals are required.

This suggests that while floating agents may still be used by some organic pear packers, this use of lignin sulfonate is no longer essential to organic production. It is on this basis that OTA is filing this petition to remove lignin sulfonate from 205.601(l)(1) as a floating agent in post-harvest handling.

13. Confidential Business Information Statement
This petition contains no confidential business information.
Petition for removal of LIGNIN SULFONATE from the National List as a synthetic substance allowed for use in organic crop production at §205.601(l) - As floating agents in postharvest handling.

Appendix A – Technical Evaluation Report
Lignin Sulfonate – Crops
February 10, 2011

Appendix B – TAP Reviews
Lignin Sulfonate – Crops
September 1995

Appendix C – National Organic Standards Board Crops Committee
2012 Sunset Proposed Recommendation
Lignin Sulfonate
April 29, 2011

Appendix D – MSDSs for Lignosite®, BorrePlex, Phyto-Plus®
Identification of Petitioned Substance

<table>
<thead>
<tr>
<th>Chemical Names:</th>
<th>28</th>
<th>CAS Numbers:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lignin sulfonate</td>
<td>29</td>
<td>8062-15-5</td>
</tr>
<tr>
<td>Other Names:</td>
<td>30</td>
<td>Lignosulfonate salts:</td>
</tr>
<tr>
<td>lignosulfonate</td>
<td>31</td>
<td>8061-51-6 (sodium lignosulfonate)</td>
</tr>
<tr>
<td>lignosulfuric acid</td>
<td>32</td>
<td>8061-54-9 (magnesium lignosulfonate)</td>
</tr>
<tr>
<td>lignosulfonic acid</td>
<td>33</td>
<td>8061-53-8 (ammonium lignosulfonate)</td>
</tr>
<tr>
<td>LST 7</td>
<td>34</td>
<td>8061-52-7 (calcium lignosulfonate)</td>
</tr>
<tr>
<td>Ligninsulonic acid</td>
<td>35</td>
<td>(U.S. EPA, 2010a)</td>
</tr>
<tr>
<td>Poly(lignosulfonic acid)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protectol W</td>
<td></td>
<td>705707 (USEPA PC Code [U.S. EPA 2010b])</td>
</tr>
<tr>
<td>Sulfite lignin</td>
<td></td>
<td>160226 (EPA Reference ID)</td>
</tr>
<tr>
<td>(NLM, 2011a)</td>
<td></td>
<td>705705, 705708-705714 (U.S. EPA PC Code [U.S. EPA, 2010b], various lignosulfonate salts)</td>
</tr>
<tr>
<td>There are also various salts of lignin sulfonate listed in the CAS Numbers section.</td>
<td></td>
<td>1522 (CODEX Alimentarius Commission INS Number, calcium lignosulfonate)</td>
</tr>
</tbody>
</table>

Trade Names:
- Lignosite® – Georgia-Pacific (Georgia-Pacific West, Inc., 2000)
- BorrePlex – LignoTech USA, Inc. (OMRI, 2010)
- Phyto-Plus® Plant Stimulator – Baicor L.C. (OMRI, 2010)
- SHADOW – LignoTech USA, Inc. (OMRI, 2010)
- Orzan – ITT Rayonnier (Sugar and Spotts, 1986)

Characterization of Petitioned Substance

Composition of the Substance:
Lignin is a constituent of woody plants that functions as a strengthening element. Lignin sulfonate is a derivative of lignin, where the lignin has been sulfonated in a wood pulping process (Zhor and Bremner, 1999). Lignin sulfonate has the chemical formula C_{20}H_{26}O_{10}S_{2} (NLM, 2011b) and its structure is presented in Figure 1. However, lignin sulfonate may be composed of a variety of sulfonated aromatic alcohols which make up lignin polymers, including p-coumaryl alcohol, sinapyl alcohol, and coniferyl alcohol (FAO, 2008). The lignin molecule is complex and not well understood in spite of its prevalence (Pure Lignin, 2010). The sulfonate complex may be in association with calcium, magnesium, ammonium, or sodium (U.S. EPA, 2010b).

The National List of Allowed and Prohibited Substances (hereafter referred to as the National List) identifies lignin sulfonate as a synthetic substance allowed for use in organic production (7 CFR 205.601). Because the lignin sulfonate molecule is negatively charged, it typically complexes with various cations to form lignin sulfonate salts. Four specific lignin sulfonate salts are included in the Generic Materials List published by the Organic Materials Review Institute (OMRI): sodium lignosulfonate, magnesium lignosulfonate, ammonium lignosulfonate, and calcium lignosulfonate (OMRI, 2010). Although these salts are not specifically named in the National List, this Technical Report provides relevant information about them when available.
Properties of the Substance:

A molecular weight of 490.5 g/mol has been reported for lignin sulfonate (NLM, 2011b). Other reports on the lignin sulfonates as a group state that they may have molecular weights ranging from 1,000 to 20,000 daltons, or higher (up to 100,000 daltons in some cases) depending on their composition (Zhor and Bremner, 1999; Hawley, 1981). Weight-average molecular weights of calcium lignosulfonate are reported to range from 40,000 to 65,000 (unitless). Calcium lignosulfonate is soluble in water and insoluble in organic solvents (FAO, 2008).

Other physical and chemical properties of lignin sulfonate are presented in Table 1. The properties presented in Table 1 describe lignin sulfonate generally, unless a specific salt is otherwise indicated.

Specific Uses of the Substance:

Lignin sulfonate may be used in organic crop production as a plant or soil amendment (dust suppressant, chelating agent) and a floatation agent for postharvest handling of products (e.g., pears). Chelating agents are large, organic molecules that are used to envelop highly-reactive trace metal ions. The purpose of chelates is to incorporate metal ions into a soluble but bound form that is capable of supplying nutrients to plants. As the chelate breaks down, the metal ion micronutrients are slowly released into the soil in a bioavailable form that may be taken up by the plant (Jones and Jacobsen, 2009). Two manufacturers produce products containing lignin sulfonate—LignoTech USA, Inc. and Baicor, L.C. (OMRI, 2010). LignoTech manufactures five products and Baicor, L.C. manufactures one product (OMRI, 2010).

Lignin sulfonates have also been investigated for their potential as chelating agents for the complexation of metal ions, including copper, magnesium, and mercury, for the purpose of environmental remediation. Garcia-Valls et al. (2001) cited the biodegradability and relatively inexpensive nature of the lignin sulfonates as factors supporting their use in remediation. Lignin sulfonates have also been used in bioremediation at dairy operation facilities and meat and seafood canneries. Lignin sulfonates were applied to waste streams at the facilities to help remove dairy and seafood waste. The lignin sulfonates formed complexes with the waste materials, which then precipitated out of wash solutions. This process allowed for diversion of some food waste from waterways. The resulting food waste/lignin sulfonate complex was then used in animal feed (USDA, 1969).
### Table 1. Chemical Properties of Lignin Sulfonate

<table>
<thead>
<tr>
<th>Chemical or Physical Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Light tan to dark brown*†‡ (CAMEO, Undated-a; CAMEO, Undated-b)</td>
</tr>
<tr>
<td>Physical State</td>
<td>Solid (powder) (Hawley, 1981)</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless (CAMEO, Undated-a)</td>
</tr>
<tr>
<td>Melting Point</td>
<td>Decomposes at &gt;200°C (&gt;392°F) (Hawley, 1981)</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>Exists in a solid state</td>
</tr>
<tr>
<td>Solubility</td>
<td>Soluble in water† (FAO, 2008)</td>
</tr>
<tr>
<td>Stability</td>
<td>Soil half-life up to one year depending on chemical species and soil flora*† (Selin et al., 1975)</td>
</tr>
<tr>
<td>Reactivity</td>
<td>Lignin sulfonates are corrosive to aluminum and aluminum alloys in the absence of calcium carbonate (CPWA, 2005)</td>
</tr>
<tr>
<td>Oxidizing or Reduction Action</td>
<td>React as acids to neutralize bases. Usually do not react as reducing or oxidizing agents (CAMEO, Undated-a)‡</td>
</tr>
<tr>
<td>Flammability/Flame Extension</td>
<td>Flash point data not available although probably combustible (CAMEO, Undated-a)†</td>
</tr>
<tr>
<td>Explodability</td>
<td>Dust explosions may occur if fine particles are mixed with air in the presence of an ignition source. Ignition temperature is approximately 250–300°C (482-572°F) † (Georgia-Pacific West, Inc., 2000)</td>
</tr>
</tbody>
</table>

*Sodium lignosulfonate
†Ammonium lignosulfonate
‡Calcium lignosulfonate

Calcium lignosulfonate may be used as an inert ingredient or adjuvant (mixing agent/sticking aid) in pesticide products, except for those exempt under Section 25(b) of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)¹ (OMRI 2010; CFR, 2003a; CFR, 2003b; CFR, 2003c). Calcium lignosulfonate is also used as an encapsulating agent or carrier for fat-soluble carotenoids, vitamins, and other functional ingredients in foods such as vitamin drinks, fruit-based beverages, hard candies, and dairy products (Toledo and Kuznesof, 2008). As discussed in the “Composition of the Substance” section, other lignin sulfonate salts are included in the OMRI Generic Materials List (OMRI 2010), but little specific information is available about them.

**Approved Legal Uses of the Substance:**

Lignin sulfonate is currently included on the National List as a synthetic substance allowed for use in organic production (7 CFR 205.601). Lignin sulfonate may be used in organic crop production as a plant or soil amendment (dust suppressant, chelating agent, or floatation agent) or a floatation agent in postharvest handling (see 7 CFR 205.601(j)(4) and 7 CFR 205.601(l)(1)). The OMRI generic materials list includes the following lignin sulfonate salts: sodium lignosulfonate, magnesium lignosulfonate, ammonium lignosulfonate, and calcium lignosulfonate (OMRI, 2010). These lignosulfonate salts are not specifically identified on the National List.

Calcium lignosulfonate (CAS No. 8061-52-7) and sodium lignosulfonate (CAS No. 8061-51-6) may be used as inert ingredients in pesticide products. These inert ingredients are on EPA’s inert ingredients list (List 4B) which, in combination with List 4A, was used as a reference for allowed inert ingredients in organic pesticide products. In 2006, EPA changed its classification system for inert ingredients, but lists 4A and 4B are still maintained for their use by the NOP. The NOP still allows inert ingredients on these lists to be used as inert ingredients in pesticide products unless the ingredients were removed following EPA...

¹ FIFRA is the federal law that regulates pesticide products in the United States and is administered by the U.S. EPA.
reassessment. Calcium lignosulfonate and sodium lignosulfonate have not been removed from the EPA List 4B and are therefore allowed for use as inert ingredients in pesticide products (NOSB, 2009).

Ammonium lignosulfonate is allowed, with restrictions, for use as a nutrient chelate in organic fertilizer products. Formulated fertilizer products that contain ammonium lignosulfonate may not make nitrogen claims on the label and/or the contribution of ammonium lignosulfonate to the total nitrogen content of the formulated product must be less than 1 percent (OMRI, 2010; CFR, 2003a; CFR, 2003b; CFR, 2003c).

Lignin sulfonate is exempt from the requirement of a tolerance when used as an inert ingredient in pre- and post-harvest agricultural production and as an inert ingredient applied to animals (CFR, 2004a; CFR, 2004b). Tolerances are acceptable levels of pesticide residues on food products that are set by the U.S. EPA, and enforced by the USDA and FDA. According to 40 CFR 180.900, “An exemption from a tolerance shall be granted when it appears that the total quantity of the pesticide chemical in or on all raw agricultural commodities for which it is useful under conditions of use currently prevailing or proposed will involve no hazard to the public health.”

**Action of the Substance:**

Lignin sulfonate acts as a dust suppressant by its large size and affinity for binding with other polar and nonpolar compounds. The smaller dust compounds adsorb to the lignin sulfonate and form a larger, heavier complex that is not as friable, which suppresses the dust (CWPA, 2005). Lignin sulfonate is used as a micronutrient chelate because it is a large compound with multiple polar and nonpolar moieties. The relatively smaller, charged micronutrient ions, such as boron, manganese, and iron, are bound to the large lignin sulfonate molecule and are slowly released into the soil in a bioavailable form (Jones and Jacobsen, 2009). Lignin sulfonate will help stabilize emulsions by acting as a surfactant. Lignin sulfonate dissolved in water is mixed with oil and preferentially adsorbs to the oil molecules, forming a barrier at the interface between the oil and water, which stabilizes the emulsion (Gundersen and Sjoblom, 1999; LignoTech, 2009). When used as a flotation aid, lignin sulfonate is added to the dump water to increase the density of the water. This is necessary for fruits like pears that may be heavier than water. Increasing the density of the water with lignin sulfonate allows the pears to float, and therefore the pears are less likely to be damaged in processing (Agar and Mitcham, 2000).

**Combinations of the Substance:**

Through its use as an emulsifier and adjuvant, lignin sulfonates (calcium lignosulfonate and sodium lignosulfonate) may be combined with various pesticide active ingredients that act as insecticides or herbicides (NOSB, 2009; OMRI, 2010; CFR, 2003a; CFR, 2003b; CFR, 2003c).

**Status**

**Historic Uses:**

Lignin sulfonate has been used in organic agricultural production as a dust suppressant, chelating agent for micro- and macronutrient fertilizer applications, flotation agent in pear production, and as an emulsifier and stabilizer for pesticide applications. A previous technical report for lignin sulfonate was created as part of the 1995 petition process to add lignin sulfonate to the National Organic Standards Board (NOSB) National List (NOSB, 1995).

Lignin sulfonate has been investigated for its potential as a chelating agent in the environmental remediation of heavy metals and in the remediation of food processing wastes (Garcia-Valls et al., 2001; USDA, 1969). Lignin sulfonate also has been used as an encapsulating agent for vitamins and other ingredients in food products (Toledo and Kuznesof, 2008).
Lignosulfonates have a variety of industrial applications. One of the main applications of lignosulfonates is in the concrete industry, where they may be used as dispersing agents and to delay the setting of concrete. In other industries, they may be used as additives in oil well drilling, dispersants for dyestuffs, cleaning agents, and as a partial substitute for phenol in the manufacture of adhesives. Sodium lignosulfonate is potentially useful in inhibiting corrosion and scale formation in recirculating cooling water systems (Ouyang et al., 2006).

**OFPA, USDA Final Rule:**

Lignin sulfonate is included within the scope of the Organic Foods Production Act of 1990 by implied inclusion in the group, “...an active synthetic ingredient in the following categories: copper and sulfur compounds…”

Lignin sulfonate is explicitly identified in the National List in 7 CFR Section 205, as follows:

- 205.601(j)(4) – Lignin sulfonate - chelating agent, dust suppressant, floatation agent
- 205.601(l) – As floating agents in postharvest handling; (1) Lignin sulfonate

**International:**

Some international organizations allow the use of lignin sulfonate in organic food production. The Canadian General Standards Board allows the use of lignin sulfonate as a dust suppressant, formulant ingredient, and chelating agent (Canadian General Standards Board, 2009).

The International Federation of Organic Agriculture Movements (IFOAM) includes calcium lignosulfonate on its “Indicative List of Substances for Organic Production and Processing.” No other lignin sulfonates are included (IFOAM, 2008). As of 2009, calcium lignosulfonate is allowed by the CODEX Alimentarius Commission as a food additive, and the compound has been assigned INS Number 1522 (Codex Alimentarius Commission, 2010).

Until 2008, lignin sulfonate was not allowed to be used in the production of certified organic products exported to Japan from the United States. In 2008, the Ministry of Agriculture, Forestry, and Fisheries (MAFF) in Japan lifted the ban of lignin sulfonate on crops imported to Japan. However, the products containing lignin sulfonate must be accompanied by an export certificate and must be imported by a JAS-certified importer (USDA, 2009). Lignin sulfonate is not specifically discussed by the European Economic Community Council Regulations.

**Evaluation Questions for Substances to be used in Organic Crop or Livestock Production**

**Evaluation Question #1:** What category in OFPA does this substance fall under: (A) Does the substance contain an active ingredient in any of the following categories: copper and sulfur compounds, toxins derived from bacteria; pheromones, soaps, horticultural oils, fish emulsions, treated seed, vitamins and minerals; livestock parasiticides and medicines and production aids including netting, tree wraps and seals, insect traps, sticky barriers, row covers, and equipment cleaners? (B) Is the substance a synthetic inert ingredient that is not classified by the EPA as inerts of toxicological concern (i.e., EPA List 4 inerts (7 U.S.C. § 6517(c)(1)(B)(ii))? Is the synthetic substance an inert ingredient which is not on EPA List 4, but is exempt from a requirement of a tolerance, per 40 CFR part 180?

(A). Lignin sulfonate is listed by inference as part of the group, “copper and sulfur compounds” in the OFPA, Section 2118 (c)(1)(B)(i).
(B). Lignin sulfonate is a synthetic inert ingredient that is not classified by EPA as an inert of toxicological concern. Lignin sulfonate (and the lignosulfonate salts) are exempt from the requirement of a tolerance under 40 CFR parts 180.910 and 180.930.

**Evaluation Question #2:** Describe the most prevalent processes used to manufacture or formulate the petitioned substance. Further, describe any chemical change that may occur during manufacture or formulation of the petitioned substance when this substance is extracted from naturally occurring plant, animal, or mineral sources (7 U.S.C. § 6502 (21)).

Lignin sulfonates are produced from the process of sulfite chemical pulping. Sulfite pulping involves cooking softwood chips under pressure in sulfur dioxide-containing cooking liquors. When the cooking process is complete, sulfonated lignin is collected as a liquid by-product in the spent liquor, while the pulp is used for paper production. The lignin sulfonates that result from the spent liquor of the sulfite pulping process must be further purified to remove excess sugars. This is done by fermentation of the liquor, followed by heating to remove the alcohol generated. The resulting lignin sulfonate polymers can have high molecular weights ranging from less than 1,000 to more than 100,000 daltons (Zhor and Bremner, 1999; Westvaco Corp., 1987).

Lignin sulfonates may also be obtained from the Kraft pulping process; these are referred to as Kraft lignins. Kraft pulping is similar to sulfite pulping, but involves treating the wood at high temperature and pressure in a water solution containing sodium sulfide and sodium hydroxide. This process dissolves lignin into a soluble salt which dissolves in the pulping liquor. The lignin is removed by precipitation from the liquor using carbon dioxide (CO\(_2\)). The Kraft lignins must then be sulfonated after extraction by reacting the material with bisulfate or a sulfite compound (Gundersen and Sjoblom, 1999; U.S. EPA, 1990).

A third pulping process, acid sulfite pulping, is similar to Kraft pulping, but different chemicals are used. Sulfurous acid, used in place of sodium hydroxide, is combined with sodium, magnesium, calcium, or ammonium bisulfite. After the cooking is complete, the pulp is separated from the spent liquor, which may then be treated to obtain various chemical materials (U.S. EPA, 1990).

**Evaluation Question #3:** Is the substance synthetic? Discuss whether the petitioned substance is formulated or manufactured by a chemical process, or created by naturally occurring biological processes (7 U.S.C. § 6502 (21)).

Lignin exists naturally in all woody plants as a structural and strengthening component. Because lignin is integrated into the plant cell wall, there are no natural processes that liberate lignin other than natural decomposition of wood by microorganisms. Lignin sulfonates are produced from the application of pressure and heat to wood in the presence of sulfur dioxide or by the addition of alkali and various acids and sulfates, as described under Evaluation Question #2. These are not naturally-occurring processes. Therefore, lignin sulfonates are synthetic (U.S. EPA, 1990; Gundersen and Sjoblom, 1999).

**Evaluation Question #4:** Describe the persistence or concentration of the petitioned substance and/or its by-products in the environment (7 U.S.C. § 6518 (m) (2)).

Lignosulfonates discharged into water bodies may cause foaming and discoloration. Due to their high biological oxygen demand (BOD) during breakdown in water, lignosulfonates will remove dissolved oxygen from waterways in amounts that may be harmful to aquatic organisms (CPWA, 2005). Little additional information is available in the published literature on the degradation pathways for lignosulfonates in water.

The half-life of lignosulfonates in soil, as evidenced by the loss of sulfates or sulfonic acid groups, is up to one year. Soil microorganisms, enzymatic reactions, and ultraviolet (UV) radiation contribute to the breakdown of lignosulfonates. The structure of lignosulfonates may be altered by wood-rotting fungi, with
polymerization being the main pathway, based on a decrease in phenolic hydroxyl groups (Selin et al., 1975). Laccase, an enzyme produced by fungi, increased degradation of lignosulfonates to low-molecular weight fractions under laboratory conditions (Cho et al., 2004). In addition to microbial decomposition, enzymatic oxidative reactions contribute to the early breakdown process of lignosulfonates. Light (UV radiation) also hastens the degradation of lignosulfonates by creating radicals capable of degrading the lignosulfonate molecular structure. This breakdown process yields lower molecular weight lignosulfonate fragments and CO$_2$. The CO$_2$ may account for 15–20% of the original organic carbon. As lignosulfonates degrade, they become more susceptible to further degradation by microbial populations. Due to the complex and heterogeneous structures of lignosulfonates, detailed information about breakdown products is difficult to describe (Lauten et al., 2010). Given that lignin is a naturally-occurring component of wood, once the sulfonic acid groups have been cleaved, the lignin that remains would likely be broken down in a manner very similar to that of rotting wood.

**Evaluation Question #5:** Describe the toxicity and mode of action of the substance and of its breakdown products and any contaminants. Describe the persistence and areas of concentration in the environment of the substance and its breakdown products (7 U.S.C. § 6518 (m) (2)).

Sodium lignosulfonate is relatively low in toxicity based on results of tests in laboratory animals, including rats, rabbits, and guinea pigs (Luscombe and Nicholls, 1973; Marcus and Watts, 1974). However, high doses of sodium lignosulfonate have been found to cause adverse health effects in laboratory animals. Rats that were given drinking water containing purified sodium lignosulfonate at a 10 g/100 ml concentration for 16 weeks had skin lesions at the bases of their tails, decreased weight gain, increased leukocyte counts, and increased kidney, spleen, and liver weights (Luscombe and Nicholls, 1973). In a study with guinea pigs and rabbits administered sodium lignosulfonate at a 1 percent concentration for a two- to six-week period, a high percentage of the animals developed ulcerative colon disease (Marcus and Watts, 1974). A median lethal oral dose of greater than 40 g/kg has been reported for rats (Luscombe and Nicholls, 1973). This dose corresponds to the U.S. EPA Toxicity Category IV for oral exposure (greater than 5000 mg/kg), which is the lowest toxicity category (U.S. EPA, 2007).

Results of a 28-day oral toxicity study in which calcium lignosulfonate was incorporated into the diet of rats at target doses of 0, 500, 1500, or 4000 mg/kg body weight per day showed no observed adverse effects other than chronic inflammation of the rectum at the highest dose level (4000 mg/kg-day). The no-observed-adverse-effect level (NOAEL) from this study was identified as 1300 and 1350 mg/kg-day for males and females, respectively (Munro and Baines, 2009).

In a 90-day study with Wistar rats dosed with calcium lignosulfonate in the diet at target doses of 0, 500, 1000, and 2000 mg/kg-day, the rats showed no adverse clinical signs or organ weight changes following complete pathological evaluations. Test results for primary immune response in the rats were normal. The only observed adverse effect was a dose-related increase in the incidence of histiocytosis (abnormal increase in the number of immune cells) of the mesenteric lymph nodes in male and female rats, with no observed histiocytosis in other lymph tissues. The Joint FAO/WHO Committee reviewed the finding of histiocytosis and concluded that it does not represent an adverse effect, based on findings with other compounds with similar properties (Munro and Baines, 2009).

No evidence of genotoxicity was found for calcium lignosulfonate in Salmonella typhimurium and Escherichia coli assays, and in a test for chromosomal aberration in Chinese hamster cells. No developmental effects were found in a study with calcium lignosulfonate and pregnant female Wistar rats. The no-observed-effect level (NOEL) for reproductive effects was identified as 1000 mg/kg-day (Munro and Baines, 2009).

Lignin sulfonates are soluble in water, so it is possible for dissolved lignosulfonates to enter waterways through direct contamination or soil runoff. Lignosulfonates in water may be toxic to fish. A 48-hour LC$_{50}$ of 7,300 parts per million (ppm) was observed by Roald (1977) for rainbow trout. As lignosulfonates break down in water, they consume dissolved oxygen in the water due to their high BOD, which may adversely
affect aquatic organisms through a decrease in available oxygen (CPWA, 2005; Jones and Mitchley, 2001).

Due to the acidic pH of lignosulfonates, large spills to waterways may also affect pH of waterways.

In the previous technical report (NOSB, 1995), a letter from the petitioner addresses concerns with dioxin as a contaminant from the process of paper pulping. Dioxin is a highly-toxic contaminant that is considered a likely human carcinogen (U.S. EPA, 2010c). The petitioner noted that dioxins are generally associated with the Kraft pulping process, and that dioxins are produced as part of pulp bleaching. The petitioner (Western Chemicals) noted that the Georgia-Pacific Corp. generates its lignosulfonates using the bisulfite pulping process (NOSB, 1995). The petitioner also explained that the sulfite liquor, which contains the lignosulfonates, is removed from the pulp before the bleaching process; thus, it is not likely that dioxins would be found in the lignosulfonates generated from this process (NOSB, 1995). In addition, the petitioner reported that they had analyzed their lignosulfonate products for dioxins and furans, and have not detected the contaminants in their lignosulfonate products above the level of detection (NOSB, 1995).

Georgia-Pacific Lignosite® 100, 260, 431-H, and 458 have been classified as biodegradable, with a hazardous decomposition product of sulfur dioxide (SO$_2$), which can adversely affect the respiratory system (Ash and Ash, 2004; U.S. EPA, 2011b). Selin et al. (1975) commented on the recalcitrant (resistant to degradation) nature of lignosulfonates, but also showed that many wood-decomposing microbes could break down lignosulfonates. As described in the Action of the Substance section, lignin sulfonates bind strongly to smaller particles in the soil or water. Once adsorbed to the soil, lignosulfonates will be degraded by soil microorganisms. Lignosulfonates may persist for six months to one year when used for dust suppression before they break down (CPWA, 2005; Selin et al., 1975).

**Evaluation Question #6:** Describe any environmental contamination that could result from the petitioned substance’s manufacture, use, misuse, or disposal (7 U.S.C. § 6518 (m) (3)).

**Manufacture:** Spent sulfite liquors from the paper pulping process contain lignin sulfonate. Before the widespread use of lignin sulfonates, these liquors were treated as waste from the sulfate pulping process and discarded or burned for energy recovery. Given that lignin sulfonate is recovered from waste products of the paper pulp industry after manufacture, the likelihood of environmental contamination from its manufacture is reduced. However, there is still the possibility that spills of effluent from paper pulping operations could contribute large amounts of lignin sulfonate to soils, nearby waterways, or environmentally-sensitive areas.

**Use:** Lignin sulfonates used as dust suppressants or in chelates applied as plant nutrients to the soil may contaminate waterways via runoff following a rain event. The primary concern regarding lignin sulfonates in waterways is their high BOD upon decomposition. This causes removal of dissolved oxygen from the water and impacts aquatic organisms (CPWA, 2005).

**Misuse:** Dust explosions may occur if finely-divided lignin sulfonate is mixed with air in the presence of an ignition source. Excessive accumulation of dust should be avoided to help prevent explosions (Georgia-Pacific West, Inc., 2000). Decomposition of lignin sulfonate can release SO$_2$, which is an eye and airway irritant (Sullivan and Krieger, 1992; Georgia-Pacific West, Inc., 2000). Excessive amounts of lignin sulfonate applied to roads for dust suppression or large amounts applied just prior to rainfall events may increase the potential for lignin sulfonate to runoff to waterways.

**Disposal:** Lignin sulfonate-treated dump water for pear processing may need to be processed in a treatment system before its disposal. The goal for treatment of these waters is reduction in BOD to a level that does not impact aquatic life (McLellan and Padilla-Zakour, 2005). Untreated dump water could adversely affect aquatic organisms by competing for dissolved oxygen. In the case of spills or accidents involving lignin sulfonate, the area should be washed with water to dilute the spill (Georgia-Pacific West, Inc., 2000). To the extent possible, care should be taken to ensure that wastewater does not flow directly to water bodies. For spills, waste disposal methods include customary procedures for industrial waste treatment (Georgia-Pacific West, Inc., 2000). Spills or releases of lignin sulfonate are not subject to the
reporting requirements of the Federal Superfund Amendments and Reauthorization Act (SARA) of 1986 (Georgia-Pacific West, Inc., 2000).

Other: Lignin sulfonates have been investigated for their potential role as chelating agents for the complexation of metal ions, including copper, magnesium, and mercury, for the purpose of environmental remediation. The biodegradability and relatively inexpensive nature of the lignin sulfonates were cited as factors that support their use in remediation (Garcia-Valls et al., 2001). In a report on lignin and its uses by USDA, lignosulfonates were discussed as treatments for food waste from milk processing plants and meat or fish canneries. The lignosulfonate complexes form a precipitate which was then added to animal feed. This application prevented some of the food waste from these operations from entering waterways (USDA, 1969).

Evaluation Question #7: Describe any known chemical interactions between the petitioned substance and other substances used in organic crop or livestock production or handling. Describe any environmental or human health effects from these chemical interactions (7 U.S.C. § 6518 (m) (1)).

Lignin sulfonates are intended to be used as chelating agents for plant nutrients, dust suppressants, and emulsifiers. By virtue of their intended use, chemical interactions of lignin sulfonates with other substances would be expected. However, lignin sulfonates are generally nonreactive by nature. When used as emulsifiers, lignin sulfonates keep chemical mixtures dispersed in solution by limiting interaction between the two constituents of the mixture (Gundersen and Sjoblom, 1999). When lignin sulfonates come into contact with small soil particles through their use as dust suppressants or chelating agents, the soil particles are adsorbed to the lignin sulfonate due to the presence of polar and non-polar areas on the surface of the lignin molecule. These interactions do not generally result in chemical change but are mostly limited to a physical binding and adsorption. The exception to this is the corrosion of aluminum and its alloys by lignin sulfonates when the material is used as a dust suppressant. This reactivity is of concern due to the prevalence of aluminum or alloy wheels, which can be corroded by the lignin sulfonate as cars with this type of wheel drive over treated roads. Mixing the lignin sulfonate with calcium carbonate in slurry neutralizes the acidic lignin sulfonate and decreases the reaction with aluminum (CPWA, 2005).

Information on environmental or human health effects from chemical interactions with lignin sulfonate was not available. As a chelating agent, lignin sulfonates could serve to reduce environmental health effects and potential toxicity to humans from exposure to the free metal ions (Garcia-Valls et al., 2001). The biodegradability and relatively inexpensive nature of the lignin sulfonates were cited as factors supporting their use in remediation (see Specific Uses and Historic Use sections and the response to Evaluation Question #6).

Evaluation Question #8: Describe any effects of the petitioned substance on biological or chemical interactions in the agro-ecosystem, including physiological effects on soil organisms (including the salt index and solubility of the soil) crops, and livestock (7 U.S.C. § 6518 (m) (5)).

Lignin sulfonates break down by physical or microbiological processes, but may persist in the soil up to one year. Lignin sulfonates are unlikely to accumulate in soil unless they are applied very frequently. Breakdown of lignin sulfonate occurs in part because lignin sulfonate is used as a carbon source by a variety of wood-decaying microorganisms. It is therefore likely that large amounts of lignin sulfonate applied to soils could stimulate soil microbial activity.

When lignin sulfonate decomposes in soil, sulfates, sulfonic acid groups, and CO₂ are liberated (Selin et al., 1975). The breakdown of a large amount of lignin sulfonate in the soil (resulting in the release of additional CO₂) could acidify the soil (CO₂ forms carbonic acid in the presence of water). Changes in pH due to the addition of large amounts lignin sulfonate could adversely affect plants and soil organisms, but these effects have not been quantified in the published literature.
Lignin sulfonate, usually as ammonium lignin sulfonate, is deliberately applied to soils when formulated as part of a plant micronutrient chelate. Micronutrient chelates, as described in the Specific Uses section, are large organic molecules used to envelop trace nutrient ions in a bound, but available form that is capable of providing nutrients to the plant while keeping the nutrient ions from forming insoluble complexes with other molecules in the soil (Jones and Jacobsen, 2009). Baicor, Inc. markets a product containing lignin sulfonates (chemical species not identified) called Plant Stimulator™ “Buffer.” The manufacturer claims that this product is also intended to stabilize soils, but does not describe how the product does this or what “stabilize soils” specifically means (Baicor, 2011).

When lignin sulfonates are discharged to waterways, their decomposition removes dissolved oxygen from water. The lack of dissolved oxygen is harmful to aquatic organisms and, depending on the amount of lignin sulfonates that is discharged, can have a negative impact on aquatic organisms to varying degrees. Lignosulfonates are corrosive to aluminum and aluminum alloys in the absence of calcium carbonate. If the corrosion of aluminum or its alloys occurs as a result of lignosulfonate application to roadways, then contamination of nearby waterways with the corrosion products could result. If the lignosulfonate is applied with calcium carbonate in slurry, the effect is neutralized (CPWA, 2005).

**Evaluation Question #9:** Discuss and summarize findings on whether the petitioned substance may be harmful to the environment (7 U.S.C. § 6517 (c) (1) (A) (i) and 7 U.S.C. § 6517 (c) (2) (A) (i)).

As discussed in Evaluation Questions #4 and #6, lignin sulfonates used as dust suppressants or in chelates applied as plant nutrients to the soil may contaminate waterways via runoff following a rain event. When used as a flotation aid for dump tanks in pear processing, lignin sulfonates may be discharged to waterways due to improper disposal of the dump water (normal disposal would require treatment of the processing water before disposal). Accidental spills of lignin sulfonate may also result in contamination of waterways. Lignin sulfonates readily dissolve in water (forming acids) and may decrease the pH of waters they contaminate. The severity of this effect will depend on the amount discharged and the characteristics of the receiving water body. Due to their high BOD during decomposition, lignosulfonates will remove dissolved oxygen from waterways in amounts that may adversely affect aquatic organisms such as fish or aquatic invertebrates (CPWA, 2005).

As discussed above for Evaluation Question #8, lignin sulfonates decompose by physical or microbiological processes, but may persist in the soil in varying amounts at up to one year. However, significant amounts of lignin sulfonates are unlikely to accumulate in agricultural soils unless they are applied frequently.

Lignin sulfonate may be applied to control road dust. If these applications are frequent and are made during very dry periods, it may lead to an accumulation of lignin sulfonates in the road bed. Runoff flows along the ground surface could transfer the accumulated lignin sulfonate to nearby terrestrial systems or waterways. Large amounts of lignin sulfonates in agricultural soils could cause a decrease in pH (due to decomposition of lignin sulfonate, release of carbon dioxide and sulfur dioxide, and formation of acids) (see Evaluation Question #8). The acidification of the soil could adversely affect crops and soil microorganisms depending on the extent of acidification.

**Evaluation Question #10:** Describe and summarize any reported effects upon human health from use of the petitioned substance (7 U.S.C. § 6517 (c) (1) (A) (i), 7 U.S.C. § 6517 (c) (2) (A) (i)) and 7 U.S.C. § 6518 (m) (4)).

The U.S. EPA issued an exemption from the requirement of a tolerance for lignin sulfonates when they are used as inert ingredients pre- and post-harvest in agricultural production. This exemption is based on the conclusion that there is a “…reasonable certainty that no harm will result…” to the general public, infants, and children from aggregate exposures (includes all dietary, drinking water, and non-occupational exposures) to lignosulfonates, as defined by the Federal Food, Drug, and Cosmetic Act (FFDCA) and the Food Quality Protection Act of 1996 (FQPA) (U.S. EPA, 2011a; Federal Register, 2005).
Evaluation Question #11: Describe all natural (non-synthetic) substances or products which may be used in place of a petitioned substance (7 U.S.C. § 6517 (c) (1) (A) (ii)). Provide a list of allowed substances that may be used in place of the petitioned substance (7 U.S.C. § 6518 (m) (6)).

Pear Flotation: No information was available on natural substances that may be used in place of the petitioned substance for pear flotation. Information was available on allowed synthetic alternatives to the petitioned substance, as summarized below.

As discussed in the Action of the Substance section, materials used to increase the specific gravity of dump water and provide flotation for pear include sodium silicate, sodium sulfate and sodium carbonate (Sugar and Spotts, 1989). Sodium silicate is an allowed synthetic substance for organic production that can be used (with restrictions) as a floating agent in postharvest handling of fruit (NOSB, 1995). Sodium sulfate is allowed for use in organic agriculture, but only as a livestock feed ingredient or in livestock healthcare (OMRI, 2010). Sodium carbonate is allowed for use in organic agriculture for processing non-agricultural ingredients and processing aids, as a crop fertilizer and soil amendment, and as a livestock feed ingredient (OMRI, 2010). There are no fruit processing or flotation uses described for sodium carbonate.

According to a survey from 1998 of pear packers in the western U.S., about 70 percent of packing houses used a form of lignin sulfonate for pear flotation (Sugar, 2002). However, a major source of lignin sulfonate in the Pacific Northwest closed prior to 2001, forcing growers to evaluate other alternatives for flotation (Sugar, 2002). Two new products were evaluated in 2001 by researchers at Oregon State University — K-Float (potassium carbonate) and Xeda F (potassium phosphate and potassium pyrophosphate) — along with sodium carbonate, calcium chloride, and sodium sulfate for their use in pear flotation. These products were evaluated at the Southern Oregon Research and Extension Center in Medford, OR, and the findings were reported at the Washington Tree Fruit Postharvest Conference on March 12th and 13th, 2002, in Yakima, WA. All tested products performed in a manner similar to lignin sulfonate to raise the density of water in dump tank solutions and allow pears to float for easier and less-damaging processing. When used in combination with Steri-Seal (an antimicrobial agent) the “relatively low” pH solutions containing Xeda F, calcium chloride, and sodium sulfate were more likely to cause fruit burn than the “relatively high” pH solutions including lignin sulfonate, sodium carbonate, and K-Float (Sugar, 2002). Fruit burn is caused in part by the increased availability of phenol that occurs at lower pH. For higher pH solutions, more Steri-Seal had to be added to dump tanks to prevent fruit infection (Sugar, 2002). In practice, multiple materials may be mixed at varying percentages in order to achieve the desired decrease in fruit injury and infection rates (Sugar, 2002). In these tests, a mixture of Xeda F with Steri-Seal disinfectant at 1 percent provided the lowest gray mold infection rate (12 percent). However, all of the alternate treatments caused some degree of fruit injury at increased dump tank temperature. The exception to the rule was lignin sulfonate, which was found to lower pH levels, but also have a “safering” property for phenol injury at a low pH (Sugar, 2002).

Dust Suppression: Magnesium chloride and calcium chloride from nonsynthetic sources are allowed for use as a dust suppressant under certain circumstances (NOSB, 1995). Magnesium chloride from synthetic sources is allowed for use in organic agriculture for dust suppression only if it is derived from seawater (NOSB, 1995). Synthetic calcium chloride is allowed for use only as a livestock feed ingredient or in livestock healthcare (NOSB, 1995). “Plant Extracts” are listed in the NOP rule (205.105), but no dust-suppressant plant extract products were identified.

Chelating Agent: Nonsynthetic amino acids and nonsynthetic citric acid are allowed for use as chelating agents in organic agriculture (NOSB, 1995). Amino acids are considered nonsynthetic if they are produced by plants, animals, and microorganisms that have not been genetically-modified or if they are extracted or isolated by hydrolysis or by physical or other nonchemical means (NOSB, 1995).
Evaluation Question #12: Describe any alternative practices that would make the use of the petitioned substance unnecessary (7 U.S.C. § 6518 (m) (6)).

Pear Flotation: Pear damage can occur throughout the harvest process, but one of the main sources of damage is when the pears are dumped from bins during rapid unloading. Dry dumps from harvest bins to packing bins can cause the most damage, whereas wet dumps (from a dry bin into a water-filled bin) decrease the potential for fruit injury. Wet dumps also allow pears to more easily move onto conveyors where they are inspected and packed. Due to the high density of pears, some are heavier than water. Flotation salts, including lignin sulfonates, are sometimes added to increase dump water density and allow the pears to float, thus reducing the chance for injury and increasing packing efficiency—a process called an immersion dump. The fruit is then circulated in the dump water using a pump, which floats the fruit to an elevator where it is rinsed and moved to a conveyor for packaging. The flotation salts could be left out of the process and non-immersion water dumps could be used. To minimize damage in non-immersion dumps from fruit-to-fruit injury, more time is required to allow fruit to move onto conveyors before additional fruit is dumped. Additional steps to reduce fruit damage have also been proposed which include using padded picking containers or plastic-lined wooden picking bins to reduce scuffing (Agar and Mitcham, 2000).

Dust Suppression: Alternate methods of dust suppression from best management practices include: vegetative cover (for non-traffic areas); mulch (including gravel mulch); sprinkling with water; spray-on adhesives (including anionic asphalt emulsion, resin in water, and latex emulsion); applications of stone or gravel to disturbed roads; barriers to control air currents; or surface roughening at angles perpendicular to prevailing winds (U.S. EPA, 2006; Idaho DEQ, 2005). Most of these methods (with the exception of adhesive applications and water sprays) do not involve applications similar to those used for lignin sulfonate, but are physical manipulations of the landscape. Cost, available resources, level of control, and the extent of the dust problem are factors that may affect the choice of dust control measures (U.S. EPA, 2006).

Researchers at Colorado State University evaluated three dust suppressants—calcium lignosulfonate, magnesium chloride, and calcium chloride—for their effectiveness in reducing dust emissions from unpaved roads (Sanders and Addo, 1993). Preliminary data analysis indicated that all suppressants reduced the dust emitted compared to untreated roads (Sanders and Addo, 1993). Final data (Sanders and Addo, 1993) showed that the aggregate loss of road height after one year was 5.18, 5.80, and 7.01 mm for roads treated with magnesium chloride, calcium lignosulfonate, and calcium chloride, respectively (Sanders and Addo, 2008). The untreated road showed an aggregate loss of 15.55 mm after one year.

Micronutrient Fertilizer Chelates: In addition to the use of allowed nonsynthetic chelates, soil fertility can be managed in other ways. Naturally-occurring chelates in the soil include humates, fulvates, and organic root exudates. Fulvates and humates are found naturally in most soils as the result of the decomposition of organic matter. Management practices, including no-till farming or manure applications, can increase organic matter in the soil and thereby increase the rate of naturally-occurring chelates (Jones and Jacobsen, 2009).

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NOSB NATIONAL LIST
FILE CHECKLIST

CROPS

MATERIAL NAME: #10 Lignin Sulfonates

- [ ] NOSB Database Form
- [ ] References
- [ ] MSDS (or equivalent)
- [ ] TAP Reviews from: Philip VanBuskirk, Brian Baker, and Diana Tracy

Crops - October 1995
NOSB/NATIONAL LIST
COMMENT FORM
CROPS

Material Name: #10 Lignin Sulfonate

Please use this page to write down comments, questions, and your anticipated vote(s).

COMMENTS/QUESTIONS:

1. In my opinion, this material is:
   _____ Synthetic   _____ Non-synthetic.

2. This material should be placed on the proposed National List as:
   _____ Prohibited Natural   _____ Allowed Synthetic.
TAP REVIEWER COMMENT FORM for USDA/NOSB

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Complete both sides of page. Attach additional sheets if you wish.

This file is due back to us by: Sept 2, 1995

Name of Material: Lignin Sulfonates
Reviewer Name: Philip Kamebishi

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

Synthetic

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

✓ Synthetic Allowed       ___ Prohibited Natural

or, ___ Non-synthetic (This material does not belong on National List)

Are there any use restrictions or limitations that should be placed on this material on the National List?

No

Please comment on the accuracy of the information in the file:

Good

Any additional comments? (attachments welcomed)

Best product for Gear Lubricant available.

Do you have a commercial interest in this material? ___ Yes; ___ No

Signature: Philip Kamebishi Date: 9/9/88
TAP REVIEWER COMMENT FORM for USDA/NOSB

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Complete both sides of page. Attach additional sheets if you wish.

This file is due back to us by: September 11, 1995

Name of Material: Lignosulfonates
Reviewer Name: Brian Baker

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

Synthetic

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

☑ Synthetic Allowed ☐ Prohibited Natural

or, ☐ Non-synthetic (This material does not belong on National List)

Are there any use restrictions or limitations that should be placed on this material on the National List?

Calcium and Magnesium Ignor. Instead, use only. Sodium possibly as an inert but not as an activator.

Please comment on the accuracy of the information in the file:

Calcium and magnesium ignored. Possibly only. Essentially complete.

Any additional comments? (attachments welcomed)

Do you have a commercial interest in this material? ☐ Yes; ☑ No

Signature ___________________________ Date 9/11/95
TAP REVIEWER COMMENT FORM for USDA/NOSB

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Complete both sides of page. Attach additional sheets if you wish.

This file is due back to us by: Sept 24 1995

Name of Material: Lignin Sulfonates

Reviewer Name: DIANA TRACY

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

SYNTHETIC

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

X Synthetic Allowed

___ Prohibited Natural

or, ___ Non-synthetic (This material does not belong on National List)

Are there any use restrictions or limitations that should be placed on this material on the National List?

NO

Please comment on the accuracy of the information in the file:

Accurate; I checked w/ a chemistry prof at WSU who has done quite a bit of research on lignosulfonates - he corroborates

Any additional comments? (attachments welcomed)

Do you have a commercial interest in this material? ___ Yes; X ___ No

Signature DIANA TRACY Date 9/1/95
Please address the 7 criteria in the Organic Foods Production Act:
(comment in those areas you feel are applicable)

(1) the potential of such substances for detrimental chemical interactions with other materials used in organic farming systems;
   LITTLE LIKLIHOOD - BREAKS DOWN LIKE WOOD - SOME AROMATICS MAY BE PRESENT (WOOD BYPRODUCTS)

(2) the toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment;

(3) the probability of environmental contamination during manufacture, use, misuse or disposal of such substance;
   POSSIBLE DURING MFR - REGULATIONS SHOULD COVER

(4) the effect of the substance on human health;
   NONE

(5) the effects of the substance on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops and livestock;
   DEPENDS ON THE MFG PROCESS; CAN HAVE MODERATELY HIGH SALT INDEX - COMPLEXED W/ Ca+ NH4 ARE DESIRABLE OVER COMPLEXED W/ Na+

(6) the alternatives to using the substance in terms of practices or other available materials; and
   ALTERNATIVES APPEAR TO HAVE WORSE AGRONOMIC IMPACT

(7) its compatibility with a system of sustainable agriculture.
   GOOD - PUTTING A WASTE PRODUCT TO GOOD USE
Appendix B

NOSB Materials Database

Identification

- **Common Name**: Lignin Sulfonates
- **Other Names**: lignosulfonate, sodium lignate, lignin by-products
- **Code #: CAS**: 8062-15-5
- **N. L. Category**: Synthetic Allowed

**Chemical Name**

**Code #: Other**

MSDS: Yes

**Chemistry**

- **Composition**: Lignin, extracted from wood, which has been treated with sulfites in the pulping process. Often in complex with calcium, magnesium, ammonium or sodium.
- **Properties**: Molecular weight of 250 is common but may extend up to 100,000 units. Soluble in water but insoluble in organic solvents. Chelation properties make it an excellent binder.
- **How Made**: Lignin is extremely difficult to separate from cellulose and other wood components in an unchanged form which is why it is considered synthetic although it is a component of wood. They are by-products of the wood and cellulose industries, with paper industry accounting for most lignosulfonates. Pulp is made in the sulfite-pulping process by cooking wood chips under pressure in a solution of sulfurous acid and either calcium, magnesium, sodium or ammonium bisulfite. This is more widely used than the kraft process for producing commercial lignins although the kraft process is more widely used in paper making. The spent liquor from the sulfite process contains 40-55% of the original wood. About 14 -17% of lignosulfonates are sold and the remainder is burned or disposed of. The Lignosulfonates can be combined with various bases either by base exchange or in the pulp digestion itself. For instance lime or calcium hydroxide may be added to make calcium lignosulfonate. The lignosulfonates are removed before the pulp is bleached. Liquid lignosulfonate is filtered, has excess $SO_2$ removed, and is distilled to purify it.

**Use/Action**

- **Type of Use**: Crops
- **Use(s)**: Used with micronutrients and macronutrients as a chelating agent, which makes the chelated nutrient ion more available to plants. Dust suppressant when used on roads and parking lots (ammonium lignosulfonate preferred). Flotation material for pears. Stabilizes emulsions and increases wetability of particle surfaces by reducing the surface free energy.
- **Action**: Chelating agents form bonds with cations such as Calcium, Zinc, Iron etc. which makes them stabilized from leaching in the soil and also available to be taken up by plant roots or leaves easily. As a dust suppressant it binds the soil particles together by generating a large cohesive force.

**Status**

- **OFPA**: 2118(c)(1)(B) sulfur compound
- **N. L. Restriction**: Allowed for use with micronutrients and macronutrients and as a chelating agent. Allowed for use as a dust suppressant.

- **EPA, FDA, etc**: Directions

- **Safety Guidelines**: State Differences

- **Registration**

- **Historical status**: usually included with the restrictions for micronutrients.

- **International status**
Appendix B

NOSB Materials Database

OFPA Criteria

2119(m)1: chemical interactions

Very reactive with other soil components but acts much as humus does: as a reservoir of soil nutrients and a buffer against sudden chemical changes.

2119(m)2: toxicity & persistence

Breaks down slowly just as natural wood does, into carbon-based organic matter and whatever cations have been attached to it. Dioxins are not present in lignosulfonates because the liquors are removed before bleaching.

2119(m)3: manufacture & disposal consequences

The paper manufacturing industry has many environmental hazards as well as regulations to follow. The hazards include the effects of logging and replanting pulp species on the land, and the pollution from effluent, burning wastes, or air contaminations that the factories give off. The use of lignin sulfonates is recycling a waste product from the paper industry that would normally be burned or end up in water supplies.

2119(m)4: effect on human health

Lignosulfonates are used in the food industry to make vanillin (artificial vanilla flavor) and as such as considered safe for human consumption by the FDA. See also attachment.

2119(m)5: agroecosystem biology

Many species of microorganisms attack wood and would therefore also break down lignosulfonates.

2119(m)6: alternatives to substance

EDTA (another synthetic chelating agent), humic acids, oil or asphalt (dust suppressant), chlorine (pears)

2119(m)7: Is it compatible?

References


See also attached.
LIGNIN SULFONATE REFERENCES

TI: Flotation materials for pears.
CN: DNAL TP440.P67

AU: Spotts,-R.A.; Cervantes,-L.A.
TI: Evaluation of disinfectant-flotation salt-surfactant combinations on decay fungi of pear in a model dump tank.
CN: DNAL 464.8-P56
AB: Several disinfectant-flotation salt-surfactant solutions were compared for effect on germination of spores of Mucor piriformis, Penicillium expansum, and Phialophora malorum and decay of pear caused by these fungi after exposure to a 7-hr dynamic circulation and spore addition phase, followed by a 16-hr static phase in a model dump tank. In aqueous systems without soil added to the tank, chlorine at 64 micrograms/ml inhibited germination from 90 to 100% in all salt solutions. Effectiveness of 4,000 micrograms sodium o-phenylphenate (SOPP) per milliliter was highest in calcium and sodium lignin sulfonate and lowest in sodium silicate solution. SOPP was less inhibitory to germination than chlorine during the first 1-3 hr of the dynamic phase. In flotation systems with 6.25 mg/ml of soil, chlorine in sodium sulfate and SOPP in sodium lignin sulfonate inhibited germination of spores and reduced decay of fruit more than in sodium silicate.

AU: Inouye,-K.
TI: Aggregate-lignin sulfonate mix.
CN: DNAL aSD388.A1U55

AU: Herrick,-F.W.; Engen,-R.J.; Goldschmid,-O.
TI: Spent sulfite liquor viscosity and lignin sulfonate molecular weight: effects of heat aging.
CN: DNAL 302.8-T162

AU: Croyle,-R-C; Long,-T-A; Hershberger,-T-V
TI: Evaluation of ammonium lignin sulfonate as a non-protein nitrogen source for sheep
CN: DNAL 49-J82
September 5, 1989

Mr. Miles Macovoy  
DEPARTMENT OF AGRICULTURE  
406 General Administration Building/AX 41  
Olympia, WA 98504

Dear Mr. Macovoy:

As we discussed this afternoon, we are interested in pursuing the necessary approvals to market our LIGNOSITE® AF Calcium Lignosulfonate and LIGNOSITE® 458 Sodium Lignosulfonate as acceptable pear flotation agents in the "organic" processing of pears.

To give you a brief background, our LIGNOSITE® lignosulfonate products are produced as co-products of the calcium bisulfite pulping process. Lignins exist naturally in trees as a binder of the cellulose fibers. In the pulping process the cellulose fibers and lignin, which becomes sulfonated, are separated, and the cellulose fibers are further processed into pulp. The liquid lignosulfonate is filtered, steam stripped to remove SO₂ and fermented with yeast to convert the fermentable hexose sugars to ethyl alcohol, which is then removed by distillation. The remaining highly purified lignosulfonate is undergoes evaporation to remove the excess water and is adjusted to a neutral pH.

We are very much aware of the public concerns regarding dioxins as related to the pulping industry. Within the pulping industry, dioxins are generally associated with the kraft pulping process and more specifically with the bleaching sequence of the pulp fibers. In the bisulfite pulping process, as used in the manufacturing of our LIGNOSITE® lignosulfonates, the spent sulfite liquor (SSL), as it is known prior to modification, is separated from the cellulose fibers prior to bleaching of the pulp; therefore, because of this separation of streams, there would be no reason to suspect the presence of dioxins in this product. We have had our LIGNOSITE products analyzed for dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin) and furan (2,3,7,8-tetrachlorodibenzoofuran), and these toxins were not detected at a detection limit of one part per trillion.

It may also be of interest to you to know that LIGNOSITE® lignosulfonates have been approved by the U.S. Food and Drug Administration for various uses within the food industry. Enclosed for your reference is a Regulatory Information and Toxicity Data sheet outlining these approvals.

We wish to thank you at this time for your interest in reviewing our LIGNOSITE® product for acceptability in the organic processing of pears. We are hopeful that this information will allow you to grant such a designation. Please feel free to call if we may offer any further assistance.

Sincerely,

Nancy E. Ryder  
Sales Representative  
Western Chemicals

NER: gj
LIGNOSITE CALCIUM LIGNOSULFONATE
Regulatory Information and Toxicity Data

(Appendix B continued)

Exposure of six rats to 198 mg/m³ of LIGNOSITE Calcium Lignosulfonate dust for four hours resulted in neither mortality nor observed signs of toxicity.

96-hour LC₅₀ Static Bioassay of LIGNOSITE Calcium Lignosulfonate liquid at 50% solids gave a lethal concentration (LC₅₀) of 4250 mg/l for juvenile rainbow trout.

OTHER

ACGIH: No threshold limit value (TLV) established by American Conference of Governmental Industrial Hygienists.

OSHA: No permissible exposure level (PEL) established by OSHA.

TSCA: Registered under Toxic Substances Control Act, initial inventory, CAS #68131-32-8.

USDA: USDA self-certification (9 CFR 317.20); is FDA-approved.

DOT: Non-regulated.

LIGNOSITE Calcium Lignosulfonate has been approved by the U. S. Forest Service for use on roads for dust abatement.

IMPORTANT: The information and data herein are believed to be accurate and have been compiled from sources believed to be reliable. It is offered for your consideration, investigation and verification. Buyer assumes all risk of use, storage and handling of the product in compliance with applicable federal, state and local laws and regulations. GEORGIA-PACIFIC MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY OR COMPLETENESS OF THE INFORMATION AND DATA HEREFIN. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE SPECIFICALLY EXCLUDED. Georgia-Pacific will not be liable for claims relating to any party's use of or reliance on information and data contained herein regardless of whether it is claimed that the information and data are inaccurate, incomplete or otherwise misleading.
MATERIAL SAFETY DATA SHEET

LIGNOSITE® 458 Sodium Lignosulfonate liquid

SECTION I - PRODUCT IDENTIFICATION

Product Name and Synonyms: LIGNOSITE 458; Sodium Lignosulfonate.

CAS Name and No: Lignosulfonic acid, sodium salt; CAS# 8061-51-6, water solution.

Chemical Family: Lignin.

Chemical Formula: Unknown.

Manufacturer's Name and Address:

GEORGIA-PACIFIC CORPORATION
300 Laurel Street (98225)
P. O. Box 1236
Bellingham, WA 98227

Telephone: 206-733-4410

Emergency Telephone Number: 1-800-424-9300 CHEMTREC

SECTION II - HAZARDOUS INGREDIENTS

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>% (WT OR VOL)</th>
<th>ACGIH TWA UNITS</th>
<th>ACGIH STEL UNITS</th>
<th>OSHA PEL UNITS</th>
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<tr>
<td>None</td>
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</table>

SECTION III - PHYSICAL PROPERTIES

Appearance and Odor: Dark brown liquid with slight odor.

Molecular Weight: Unknown.

Boiling Point (Degrees Fahrenheit): Around 212.

Melting Point (Degrees Fahrenheit): Around 32.

Vapor Pressure (MM of Mercury): Water (approx. 7-8)

Specific Gravity (Water = 1): Approx. 1.25

Vapor Density (Air = 1): N/A.

Percent Volatile (By Weight): Approx. 53% water.

pH: Approximately 6-8.
Solubility in Water: Soluble.

Evaporation Rate (Butyl Acetate = 1): Unknown.

SECTION IV - FIRE AND EXPLOSION DATA

Flash Point: None.

Fire Extinguishing Media: Water or CO₂.

Flammable Limits (Percent by Volume):

LOWER  UPPER

N/A

Special Fire Fighting Procedures & Equipment: Normal.

Unusual Fire and Explosion Hazards: N/A

SECTION V - REACTIVITY DATA

Stability: UNSTABLE  STABLE  X

Conditions to Avoid: None known.

Incompatibility (Materials to Avoid): Caution necessary with strong oxidizing agents.

Hazardous Decomposition Products: Sulfur dioxide (SO₂) possible.

Hazardous Polymerization: WILL OCCUR  WILL NOT OCCUR  X

Conditions to Avoid: N/A.

SECTION VI - HEALTH HAZARD INFORMATION

Effects from Routine Use: None known.

Effects of Overexposure: None known.

Probable Routes of Exposure: Skin, eyes.

Emergency and First Aid Procedures:

Ingestion: N/A

Inhalation: Move to fresh air.
Eye Contact: Rinse with running water. Hold eyelids apart while irrigating.

Skin Contact: Wash affected area thoroughly with water.

SECTION VII - TOXICITY DATA

Oral: This material is not toxic when administered orally to rats under the Federal Hazardous Substances Act (FHSA) criteria.

Dermal: This material is not an irritant when applied as a moist powder to the skin of rabbits under the FHSA criteria.

Inhalation: Unknown.

Carcinogenicity: Not listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

Other Pertinent Data: This material is not an eye irritant when applied (in a 40% solution) to the eyes of rabbits under the FHSA criteria.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Personal Protective Equipment

Protective Gloves: Rubber gloves recommended.

Eye Protection: Goggles recommended.

Respiratory Protection (Specify Type): NIOSH-approved sulfur dioxide respirator recommended for hot vapors of solutions.

Other Protective Equipment: As appropriate to prevent contact with body.

Ventilation:

Local Exhaust: N/A.

Mechanical (General): N/A.

Special: None.

Other: None.
SECTION IX - SPILL, LEAK, AND DISPOSAL PROCEDURES

Steps to be Taken in Case Material is Released or Spilled:

Wash area with water. Spills or releases of this material do not currently trigger the emergency release reporting requirements under the federal Superfund Amendments and Reauthorization Act of 1986 (SARA). State and local laws may differ from federal law. Consult counsel for further guidance on your responsibilities under these laws.

Waste Disposal Methods:

Customary plant procedures for industrial waste treatment.

Clean Water Act Requirements: N/A.

Resource Conservation and Recovery Act (RCRA) Requirements: N/A.

SECTION X - REGULATORY INFORMATION

FDA: Sodium lignin sulfonate is regulated under 21 CFR 175.105 as a substance for use as component of adhesives. Under 21 CFR 176.170, it may be safely used as a component of the uncoated or coated food-contact surface of paper and paperboard intended for use in producing, manufacturing, packaging, processing, preparing, treating, packing, transporting, or holding of aqueous and fatty foods. Under 21 CFR 176.210, it is also permitted for use in the formulation of defoaming agents used in the manufacture of paper and paperboard intended for use in packaging, transporting, or holding food. Under 21 CFR 573.600, lignin sulfonates are approved for use in animal feeds, either in liquid or liquid form, up to 4% of finished feed.

USDA: USDA self-certified (9 CFR 317.20); is FDA approved.

CPSC: N/A.

TSCA: CAS #: 8061-51-6.

DOT: Non-regulated.

Proper Shipping Name: Lignin Liquor.

Hazard Class: N/A.

Label Required: None.

Identification No: N/A.

Other Pertinent Information: N/A.
Formal Recommendation by the National Organic Standards Board (NOSB) to the National Organic Program (NOP)

Date: April 29, 2011

Subject: Lignin Sulfonate § 205.601(l) relisting for Sunset 2012

Chair: Tracy Miedema

The NOSB hereby recommends to the NOP the following:

Rulemaking Action X
Guidance Statement
Other

Statement of the Recommendation (Including Recount of Vote):

The Board recommends the continued listing of Lignin Sulfonate on 205.601 (l) as floating agents in post harvest handling.

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

There were concerns during the last round of sunset for this material about its fate in waste water when it is used as a flotation agent. On February 15, 2011 the Crops Committee addressed this concern with an annotation to relist lignin sulfonate on 205.601 (l) with the amended annotation: As floating agents in postharvest handling, subject to wastewater disposal documentation in the Organic Systems Plan to prevent adverse impact to aquatic life. It was also noted that there is a duplicate listing as a flotation agent in (j) As plant or soil amendments, so the Crops Committee is recommending relisting lignin sulfonate as plant or soil amendments with the annotation change: chelating agent, dust suppressant (see separate recommendation). The Crops Committee considered new public comment in reviewing this material, finding that existing regulatory oversight is adequate to the task of monitoring wastewater disposal concerns and recommended relisting this material as is.

Committee Vote:

<table>
<thead>
<tr>
<th>Moved:</th>
<th>John Foster</th>
<th>Second:</th>
<th>Steve Demuri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes:</td>
<td>14</td>
<td>No:</td>
<td>0</td>
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<tr>
<td>Abstain:</td>
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<tr>
<td>Recusal:</td>
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</tbody>
</table>

Updated June 17, 2010
National Organic Standards Board  
Crops Committee  
2012 Sunset Proposed Recommendation  
Lignin sulfonate  

April 29, 2011


(l) As floating agents in postharvest handling.
   (1) Lignin sulfonate.

Committee Summary

There were concerns during the last round of sunset for this material about its fate in waste water when it is used as a flotation agent. On February 15, 2011 the Crops Committee addressed this concern with an annotation to relist lignin sulfonate on 205.601 (l) with the amended annotation: As floating agents in postharvest handling, subject to wastewater disposal documentation in the Organic Systems Plan to prevent adverse impact to aquatic life. It was also noted that there is a duplicate listing as a flotation agent in (j) As plant or soil amendments, so the Crops Committee is recommending relisting lignin sulfonate as plant or soil amendments with the annotation change: chelating agent, dust suppressant.

The Crops Committee considered new public comment in reviewing this material, finding that existing regulatory oversight is adequate to the task of monitoring wastewater disposal concerns and did not reconsider the motion for the listing of this material as a crop or soil input.

Committee Recommendation

Relist lignin sulfonate on § 205.601(l): As floating agents in postharvest handling (1) Lignin sulfonate

Committee Vote

Motion: Tina Ellor  Second: Steve Demuri
Yes: 7  No: 0  Absent: 0  Abstain: 0  Recuse: 0
LIGNOSITE® 458 SODIUM LIGNOSULFONATE POWDER

SECTION 1 - PRODUCT IDENTIFICATION

Product Name and Synonyms:
LIGNOSITE® 458; Sodium Lignosulfonate.

Manufacturer’s Name and Address
GEORGIA-PACIFIC WEST, INC.
300 W. Laurel Street (98225)
P.O. Box 1236
Bellingham, WA 98227
Telephone: 360-733-4410

Emergency Telephone Number
1-800-424-9300 CHEMTREC

SECTION 2 - HAZARDOUS INGREDIENTS

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>% WEIGHT OR VOL</th>
<th>ACGIH TWA UNITS</th>
<th>ACGIH STEL UNITS</th>
<th>OSHA PEL UNITS</th>
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</thead>
<tbody>
<tr>
<td>None</td>
<td>---</td>
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</tr>
</tbody>
</table>

SECTION 3 - PHYSICAL PROPERTIES

Appearance and Odor: Brown powder with no appreciable odor.

Molecular Weight: Unknown.

Boiling Point (Degrees Fahrenheit): Solid.

Melting Point (Degrees Fahrenheit): Decomposes.

Vapor Pressure (MM of Mercury): Nil.

Specific Gravity (Water = 1): Approx. 0.5.

Vapor Density (Air = 1): Not applicable.

Percent Volatile (By Weight): 2-10% moisture.

pH: Approx. 6 - 8.

Solubility in Water: Soluble.

Evaporation Rate (Butyl Acetate = 1): Not applicable.

SECTION 4 - FIRE AND EXPLOSION DATA

Flash Point: Not applicable.

Fire Extinguishing Media: Water or CO₂.

Flammable Limits (Percent by Volume): Lower: Not applicable. Upper: Not applicable.

Special Firefighting Procedures & Equipment: Normal.

Unusual Fire and Explosion Hazards: Dust explosions may occur when finely divided particles are mixed with air in the presence of an ignition source. Avoid excessive accumulation of dust on floors, beams, or machinery. Ignition temperature is approximately 250-300°C.
SECTION 5 - REACTIVITY DATA

**Stability:** Unstable ___ Stable _X_

**Conditions to Avoid:** None known.

**Incompatibility** *(Materials to Avoid)*: Caution necessary with strong oxidizing agents.

**Hazardous Decomposition Products:** Sulfur dioxide (SO$_2$) possible.

**Hazardous Polymerization:** Will Occur ___ Will Not Occur _X_

**Conditions to Avoid:** None known.

SECTION 6 - HEALTH HAZARD INFORMATION

**Exposure from Routine Use:** None known.

**Effects of Overexposure:** Prolonged exposure to high levels of dust in air may cause sneezing, coughing, or other nuisance symptoms.

**Probable Routes of Exposure:** Skin, inhalation, eyes.

**Emergency First Aid Procedures**

**Eye Contact:** Rinse immediately with water. Remove contact lenses; flush eyes with water. Consult a physician if necessary.

**Skin Contact:** Wash skin with soap and water. Seek medical attention if irritation persists. Launder contaminated clothing before re-use.

**Inhalation:** Move to fresh air to relieve nuisance symptoms.

**Ingestion:** Rinse mouth. Immediately dilute by drinking large quantities of water. After dilution, induce vomiting. Seek immediate medical attention. Never give anything by mouth to an unconscious person.

SECTION 7 - TOXICITY DATA

**Oral:** This material is not orally toxic when tested as described in 29 CFR 1910.1200, Appendix A.

**Dermal:** This material is not a primary irritant and is not dermally toxic when tested as described in 29 CFR

**Inhalation:** Four-hour exposure of rats to 198 mg/m$^3$ of dust has resulted in neither mortality nor observable signs of toxicity.

**Carcinogenicity:** Not listed as a carcinogen by IARC, NTP, OSHA, or ACGIH.

**Other Pertinent Data:** This material is not an eye irritant when tested as described in 29 CFR 1910.1200, Appendix A.
SECTION 8 - SPECIAL PROTECTION INFORMATION

Personal Protective Equipment

Protective Gloves: Rubber gloves recommended.

Eye Protection: Goggles recommended.

Respiratory Protection (Specify Type): Air purifying respirator recommended for prolonged exposure to high concentrations.

Other Protective Equipment: As appropriate to prevent contact with body.

Ventilation

Local Exhaust: Recommended. Because of the explosive potential of organic dust when suspended in air, precautions should be taken to prevent sparks or other ignition sources in ventilation equipment. Use of totally enclosed motors is recommended.

Mechanical (General): Recommended.

Special: Use explosion-proof equipment for dusty conditions.

Other: None.

SECTION 9 - SPILL, LEAK, AND DISPOSAL PROCEDURES

Steps to be Taken in Case Material is Released or Spilled

Wash area with water. Spills or releases of this material do not currently trigger the emergency release reporting requirements under the federal Superfund Amendments and Reauthorization Act of 1986 (SARA). State and local laws may differ from federal law. Consult counsel for further guidance on your responsibilities under these laws.


Clean Water Act Requirements: None known.

Resource Conversation and Recovery Act (RCRA) Requirements: None known.

SECTION 10 - REGULATORY INFORMATION

FDA: Sodium lignin sulfonate is regulated under 21 CFR 175.105 as a substance for use as a component of adhesives. Under 21 CFR 176.170, it may be safely used as a component of the uncoated or coated food-contact surface of paper and paperboard intended for use in producing, manufacturing, packaging, processing, preparing, treating, packing, transporting, or holding of aqueous and fatty foods. Unity foods. Under 21 CFR 176.210, it is also permitted for use in the formulation of defoaming agents used in the manufacture of paper and paperboard intended for use in packaging, transporting, or holding food. Uning food. Under 21 CFR 573.600, lignin sulfonates are approved for use in animal feeds, either in liquid or powder form, up to 4% of finished feed.

USDA: USDA self-certified (9 CFR 317.20); is FDA approved.

CPSC: Not applicable.

TSCA: CAS# 8061-51-6, Lignosulfonic Acid, Sodium Salt.

DOT: Non-regulated.

Proper Shipping Name: None.

Identification No.: None.

Hazard Class: None.

Other Pertinent Information: None.

Label Required: None.
SECTION 11 - SPECIAL PRECAUTIONS AND COMMENTS

Precautions to be Taken in Handling and Storing

Store in a dry place and keep sealed until ready to use to prevent caking from moisture pickup. This material is biodegradable. Use caution when opening unvented containers of water solutions. Microbial activity may cause pressure accumulation.

Other Precautions: None known.

Registrations / Certifications: None.

Effective Date: 1/01/00

Supersedes: 5/27/98

IMPORTANT: The information and data herein are believed to be accurate and have been compiled from sources believed to be reliable. It is offered for your consideration, investigation and verification. Buyer assumes all risk of use, storage and handling of the product in compliance with applicable federal, state and local laws and regulations. GEORGIA-PACIFIC MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY OR COMPLETENESS OF THE INFORMATION AND DATA HEREIN. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE SPECIFICALLY EXCLUDED. Georgia-Pacific will not be liable for claims relating to any party's use of or reliance on information and data contained herein regardless of whether it is claimed that the information and data are inaccurate, incomplete, or otherwise misleading.

The symbol "•" indicates revision from previous issue.
MATERIAL SAFETY DATA SHEET

BorrePlex OA LIQUID

Internal No.: 203292 Date Prepared: 03/15/2011 Replaces: All Previous

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Trade Name: Calcium Lignosulfonate, Lignosulfonic Acid Mixture
Synonyms: See Above
CAS Numbers: 8061-52-7 + 8062-15-5
Manufacturer: LignoTech USA, Inc.
100 Grand Avenue
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*CHEMTREC PHONE +1(800)424-9300

*Use only in the event of chemical emergencies involving a spill, leak, fire, exposure, or accident involving chemicals

SECTION 2. HAZARDOUS IDENTIFICATION

Emergency Overview: Considered an irritant to mucous membranes, skin and eyes. Characteristic of mild organic acids due to low pH.

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>EINECS No.</th>
<th>CAS No.</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Lignosulfonate</td>
<td>Exempt Polymer</td>
<td>8061-52-7</td>
<td>Proprietary</td>
</tr>
<tr>
<td>Lignosulfonic Acid</td>
<td>Exempt Polymer</td>
<td>8062-15-5</td>
<td>Proprietary</td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td>7732-18-5</td>
<td>45%</td>
</tr>
<tr>
<td>Component A</td>
<td></td>
<td></td>
<td>Proprietary</td>
</tr>
</tbody>
</table>

SECTION 4. FIRST AID MEASURES

Eyes: Flush eyes with water for at least 15 min. and consult with physician.
Skin: Wash skin with soap and water and consult with physician if problem occurs. Remove contaminated clothing.
Inhalation: Move to fresh air.
Ingestion: Give water to dilute and get medical attention.

SECTION 5. FIRE FIGHTING MEASURES

Extinguishing Media: Not Applicable
Improper Extinguishing Media: Not Applicable
Special Fire Fighting Procedures: None.
Fire and Explosion Hazards: May react with metals (iron, zinc or aluminum) to form highly flammable hydrogen

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Use personal protection recommended in Section 8.
Environmental Precautions: Avoid infiltration of large quantities into drains, surface water, groundwater and soil
Methods for Containment: Stop leak, use berms, dikes, absorbent material and drain covers.
Methods for Clean-up: Mechanically collect and remove spilled material. Area may be washed with water. Can be neutralized with sodium carbonate or bicarbonate.
SECTION 7. HANDLING AND STORAGE

Handling Precautions: Wash thoroughly after handling. Remove all contaminated clothing and wash before re-use. Use with adequate ventilation. Do not get on skin or in eyes. Avoid inhalation or ingestion.

Storage: Store in an area with secondary containment, cool, dry, well ventilated, away from incompatible substances.

SECTION 8. EXPOSURE CONTROLS /PERSONAL PROTECTION

OSHA PELV: None established. Minimize contact with eyes, skin, clothing.
Exposure Control: Use adequate general or local exhaust ventilation.
Respiratory Protection: Use NIOSH approved respirator when dusts, mists, or vapors are present.
Hand Protection: Wear appropriate gloves to prevent skin exposure.
Eye Protection: Wear appropriate eye glasses or chemical safety goggles.
Personal Protection: Wear appropriate protective clothing to prevent skin exposure.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid
Melting Point: Not Applicable
Boiling Point (C): 104 C
Freezing Point (C): -2 C
Vapor Pressure (mm Hg): 14.2 @ 20 C
Vapor Density (Air = 1): 1.21 @ 20 C
% Volatiles By Weight: 43 - 47 (water)
Appearance & Odor: Brown liquid with slight odor

SECTION 10. STABILITY AND REACTIVITY

Stability: Stable.
Incompatible Materials: Contact with strong oxidizing agents, iron, zinc, aluminum.
Hazardous Decomposition Products: Typical combustion products. May react with metals (iron, zinc, aluminum) to form highly flammable hydrogen gas which can form explosive mixtures with air.
Hazardous Polymerization: Will not occur.
Conditions to Avoid: None known.

SECTION 11. TOXICOLOGICAL INFORMATION

ACUTE (SINGLE EXPOSURE) TOXIC TESTS. PRODUCT/SIMILAR PRODUCT

Route of exposure  Value/unit  Species
Oral LD50  No Data  Rat

Skin Contact: Considered mild irritant due to pH.
Eye Contact: Considered an irritant characteristic of mild organic acid due to pH.
Sensitization to Material: None known.

CHRONIC TOXICITY:
Carcinogen Listings: Not a carcinogen.
Mutagenicity: None Known.

SECTION 12. ECOLOGICAL INFORMATION

PRODUCT/SIMILAR PRODUCT
Biological oxygen demand(BOD): Partially biodegradable.
Chemical oxygen demand(COD):
SECTION 13. DISPOSAL INFORMATION

General Regulations: Dispose or destroy in accordance with official recommendations and applicable legislation.

SECTION 14. TRANSPORTATION INFORMATION

Shipping Name - DOT: Lignin Liquor - Class 55
Hazard Class - DOT: Not Restricted
UN Number: Excluded
Harmonized Tariff Code for US: 3804.00.1000-0
Hazard Class - IATA: Not Restricted
EU Classified as Dangerous Goods: No

SECTION 15. REGULATORY INFORMATION

GLOBAL CHEMICAL INVENTORY STATUS

SECTION 16. OTHER INFORMATION

HMIS Rating(0-4) HEALTH = 1 FIRE = 0 REACTIVITY = 0 SPECIAL = 0

Prepared by: LignoTech USA, Inc.

Tim McNally

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MATERIAL SAFETY DATA SHEET

SECTION 1

CHEMICAL NAME: Sodium Ligno-Sulfonate
PRODUCT NAME: (OMRI) Plant Stimulator (Buffer)
MANUFACTURERS NAME: BAICOR L.C.
% ACTIVITY: 3.0% lingo-sulfonate
ADDRESS: 1895 North 600 West, Logan Utah 84321
EMERGENCY TELEPHONE NO.: (435) 752-2475

SECTION 2 HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

HAZARDOUS COMPONENTS
(SPECIFIC CHEMICAL IDENTITY; OSHA PEL  ACGIH TLV  C.A.S. NO.           SARA
Mixture
COMMON NAME)       (Mg/lb)       (Mg/lb)       %
____________________________________________________________________________________________________
None

SECTION 3 - PHYSICAL/CHEMICAL CHARACTERISTICS

BOILING POINT: > H2O
MELTING POINT:N/A
pH: 1.5
APPEARANCE AND ODOR: Dark Brown, slight odor.

SECTION 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD): N/A
FLAMMABLE LIMITS: LEL N/A UEL N/A
EXTINGUISHING MEDIA: Water
SPECIAL FIREFIGHTING PROCEDURES: N/A
UNUSUAL FIRE & EXPLOSION HAZARDS: N/A

SECTION 5 - REACTIVITY DATA

STABILITY: STABLE: X  UNSTABLE: CONDITIONS TO AVOID: N/A
INCOMPATIBILITY (MATERIALS TO AVOID): N/A
HAZARD DECOMPOSITION OR BY-PRODUCTS: N/A
HAZARD POLYMERIZATION: MAY OCCUR:  MAY NOT OCCUR: X
CONDITIONS TO AVOID: N/A

SECTION 6 - HEALTH HAZARD DATA

PRODUCT: (OMRI) Plant stimulator (Buffer)
TOXICITY: None found
ROUTES (S) OF ENTRY: INHALATION  SKIN: X  INGESTION: X
CARCINOGENICITY: NTP: NO  IARC MONOGRAPHS: NO  OSHA REGULATED: NO
HEALTH HAZARDS (ACUTE & CHRONIC)/SIGNS AND SYMPTOMS OF EXPOSURE:
This product may cause eye and skin irritation (See emergency and first aid procedures).

EMERGENCY AND FIRST AID PROCEDURES:
Eyes: Immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.
Skin: Wash contaminated areas with plenty of water for 15 minutes. Remove contaminated clothing and footwear and wash clothing before reuse. If skin irritation continues consult a physician.

Ingestion: Do not give anything by mouth to an unconscious person. If swallowed do not induce vomiting, give one or two glasses of milk or water. Contact a physician immediately.

SECTION 7 - PRECAUTION FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Absorb liquid spills with a dry absorbent, containerize unusable material for disposal in an approved waste facility.

WASTE DISPOSAL METHOD: Dispose in closed containers, at an approved landfill, in accordance with local, state and federal regulations. Material may also be flushed with water to a wastewater treatment system.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Store in original plastic containers in a cool, well-ventilated, dry place at temperatures above 50 degrees C. Do not store in contact with strong alkalies, acids, oxidizing agents. Do not stack pallets more than two high.

OTHER PRECAUTIONS: Avoid Ingestion, contact with eyes, skin and clothing.

SECTION 8 - CONTROL MEASURES

RESPIRATORY PROTECTION: NIOSH/MSHA approved for mists. Use with adequate ventilation and employ respiratory protection when exposure to mist and spray is possible.

VENTILATION: N/A (have adequate ventilation.

PROTECTIVE GLOVES: Impervious gloves.

EYE PROTECTION: Side shield safety glasses or goggles.

OTHER PROTECTIVE CLOTHING AND EQUIPMENT: Protective clothing to minimize skin contact should be worn. Chemically-resistant safety shoes. Wash contaminated clothing with soap and water and dry before reuse. Safety showers and eye wash facilities should be provided in all areas in which this product is handled.

WORK/HYGIENIC PRACTICES: Good housekeeping procedures should be followed to minimize exposure.

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