

**Measuring Effluent:  
Clarification of Chlorine Contact with Organic Food  
NOSB Processing Committee  
April 30, 2003**

**I. Introduction** – The National List contains annotations for the use of chlorine compounds which do not accurately convey the annotations recommended by the NOSB. As a result, the Questions and Answers posted on the NOP website focus on measuring chlorine levels at the effluent or discharge site of the facility, rather than at the point where the chlorine solution contacts organic food. This has led to confusion among processors, certifying agents, and inspectors, and has led to inconsistent application of the NOP rule. The NOSB Processing Committee recommends that the annotations be corrected to accurately reflect the original NOSB recommendation, that the Q & A's be re-phrased to provide accurate and consistent guidance, and that the review of chlorine should be prioritized in the re-review process in light of new information about the use of chlorine compounds.

**II. Background** – The sections below contain existing National List citations, the original NOSB recommendation, a Preamble citation, NOP website questions and answers, language from the NOSB Materials Review Task Force recommendation, and discussion of the issue.

**A. National List Citations**

The National List currently states the following about the use of chlorine:

§ 205.601(a) As algicide, disinfectants, and sanitizer, including irrigation system cleaning systems  
(2) Chlorine materials - Except, That, residual chlorine levels in the water shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act.

- (i) Calcium hypochlorite
- (ii) Chlorine dioxide
- (iii) Sodium hypochlorite

§ 205.603(a) As disinfectants, sanitizer, and medical treatments as applicable  
(3) Chlorine materials - disinfecting and sanitizing facilities and equipment. Residual chlorine levels in the water shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act.

- (i) Calcium hypochlorite
- (ii) Chlorine dioxide
- (iii) Sodium hypochlorite

§ 205.605(b) Synthetics allowed:

(9) Chlorine materials - disinfecting and sanitizing food contact surfaces, Except, That, residual chlorine levels in the water shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act.

- (i) Calcium hypochlorite
- (ii) Chlorine dioxide
- (iii) Sodium hypochlorite

**B. Original NOSB Recommendation**

In November, 1995, the NOSB approved the following recommendation concerning the use of chlorine:

Chlorine Bleach (Calcium hypochlorite, sodium hypochlorite, chlorine dioxide) -  
Determined to be synthetic; Vote - Unanimous (2 absent).

The NOSB's decision is to allow this material for use for organic crop production, organic food processing, and organic livestock production.

Vote: 9 aye / 2 opposed / 2 absent.

Annotation: Allowed for disinfecting and sanitizing food contact surfaces. Residual chlorine levels for wash water in direct crop or food contact and in flush water from cleaning irrigation systems that is applied to crops or fields cannot exceed the maximum residual disinfectant limit under the Safe Drinking Water Act (currently 4mg/L expressed as Cl<sub>2</sub>). This substance is to be reviewed again in two years.

The critical words missing from the National List annotation are: *“for wash water in direct crop or food contact and in flush water from cleaning irrigation systems that is applied to crops or fields”*.

### **C. Preamble**

The lack of the key words as stated in the original NOSB recommendation, and confusion over the term “residual chlorine” has led the NOP to focus on chlorine levels in waste water, as reflected in the Preamble, page 80616, which states:

“(5) Chlorine Disinfectant Limit Annotation for Organic Production and Handling. Some commenters requested clarification on the annotation for using chlorine materials as an allowed synthetic substance in crop and handling operations. The annotation in the proposed rule, which has been retained in the final rule, stated that “residual chlorine levels in the water shall not exceed the maximum residual disinfectant limit under the Safe Water Drinking Act.” With this annotation, the residual chlorine levels at the point where the waste water stream leaves the production or handling operation must meet limits under the Safe Drinking Water Act.”

### **D. Website Questions and Answers**

From the NOP website, 4/10/03:

Use of Chlorine in Organic Handling Operations - 7 C.F.R 205.601(a)(2), 205.603(a)(3), and 205.605(b)(9) provides for the use of chlorine materials as algicides, disinfectants and sanitizers in organic crop, livestock and handling operations. The annotation on the use of chlorine materials restricts the residual chlorine levels in the water to the maximum residual disinfectant limit under the Safe Drinking Water Act. This limit is currently established by the Environmental Protection Agency (EPA) at 4 mg/L for chlorine. The National Organic Program has received a number of questions regarding the use of chlorine in certified operations and the sampling protocol to be used by accredited certifying agents (ACA) in monitoring the maximum residual disinfectant limit for chlorine materials. The following Q and A's are designed to clarify these issues.

Q. As an ACA, at what point in crop, livestock or handling operations should I monitor for the maximum residual disinfectant limit?

A. ACA's must monitor the discharge or effluent point to ensure that certified operators are meeting the 4 mg/L limit as set forth by the Safe Drinking Water Act.

Q. As a crop, livestock or handling operation, am I restricted to use chlorine at the maximum residual disinfectant limit specified under the Safe Drinking Water Act, currently 4 mg/L, at the beginning of the wash/rinse water cycle?

A. No. Levels of chlorine used to prepare water to be used to disinfect/sanitize tools, equipment, product or food contact surfaces may be higher than 4 mg/L and should be at levels sufficient to control microbial contaminants. Therefore, chlorine use at the beginning of the applicable water cycle in an organic operation is not limited to 4 mg/L.

Q. What is the “maximum residual disinfectant level?”

A. "Maximum residual disinfectant level" is a term defined by the Environmental Protection Agency (EPA) as the highest level of a disinfectant allowed in drinking water. This level is currently established by EPA at 4 mg/L for chlorine. Practically applied under the National Organic Standards, the term "maximum residual disinfectant level" refers to the chlorine level of the waste water at the discharge or effluent point.

#### **E. NOSB Processing Committee Recommendation on Materials Review**

The following language is excerpted from the Processing Committee's Materials Review Recommendation adopted by the NOSB on 10/20/02:

**The NOSB Processing Taskforce recommends that the annotation referencing the use of chlorine on food contact surfaces is beyond the scope of NOSB review. The use of chlorine in water used as an ingredient, however, is within the scope, and is subject to the National List review process. Therefore, the taskforce recommends that the words, "disinfecting and sanitizing food contact surfaces, Except, That," be deleted from the annotation. [205.605(b)(9)]**

Rationale: As stated above, indirect additives, including surface sanitizers should not require National List approval before they can be used to remove pathogens from surfaces that may contact organic food products.

The use of cleansers and sanitizers is regulated by the Model Food Code and Good Manufacturing Practices (GMPs). As such, prevention of contact with organic products must be adhered to by following GMPs, such as rinses and/or products purges, as described in an operation's Organic Handling Plan and verified by certification.

#### **F. Discussion**

Central to the issue of clarification regarding chlorine sanitizers is the uncertainty of a defined point of measurement in order to assess compliance.

When sodium or calcium hypochlorite is used in flume wash waters the language of the Q & A's indicates that chlorine levels must meet EPA levels for drinking water not to exceed 4 ppm. In order to insure compliance, the NOP suggests that chlorine monitoring be conducted at the discharge point. The discharge point of a flume water wash operation is usually interpreted to be the point of discharge of the dirty flume wash water either to a municipal sewer system or effluent pond. Therefore, it seems that compliance is centered on the level of chlorine in the wastewater.

The intent of the original NOSB recommendation for chlorine level compliance was to ensure that chlorine levels of water in contact with organic commodity (i.e., fruit/vegetable/meat), do not exceed 4 mg/l (4 ppm) of residual chlorine. This requires that the operator measure the chlorine level in water immediately prior to contact with food, not the chlorine level of waste water. Only the level of chlorine in the water that contacts organic food products is relevant for verifying compliance of handling and post-harvest handling operations.

The waste water levels are only relevant to operations that irrigate certified organic fields with recirculated water from washing equipment. If the water used in food is measured to comply with that prior to contact with food, this should be sufficient provided no chlorine is added after food contact. There is no upper chlorine limit for cleaning equipment, but the effluent would still need to be measured if that water is used to irrigate land in certified organic production.

The Organic Foods Production Act is not designed to function as a waste water regulation. Instead, it is a regulation designed to protect organic integrity. As such, processing operations must demonstrate compliance with the chlorine annotation by monitoring the chlorine content of

the water which is in direct contact with organic products, not the wash water which is discharged from the facility.

According to the NOSB recommendation in 1995, any level of chlorine is permitted for in-plant sanitizing operations of equipment and food contact surfaces. When food contact surfaces or equipment are sanitized using levels of chlorine above the 4ppm level, certifiers may require an intervening rinse with potable water to insure that organic products are not subsequently affected by the sanitizing levels.

Wash water in direct crop or food contact can be measured to insure compliance with the 4 ppm or less requirement. As applicable, a description of the operation's monitoring procedure is to be contained in the operation's Organic System Plan. Documents which demonstrate compliance are to be reviewed and verified during the operation's annual inspection.

Further, the preamble is technically incorrect when it indicates that residual chlorine is the chlorine that is present at the discharge point. "Residual chlorine" is a technical term, used when measuring chlorine, related to the term "free chlorine". Another measurement is "total" chlorine. Residual chlorine is the chlorine left in solution after some of the added chlorine material has bound to the organic matter (soil) and become unavailable. The residual chlorine is what is still available to oxidize other substances.

"Residual" chlorine is the fraction of available chlorine in solution derived from the disinfectant source.<sup>1</sup> Total chlorine includes free plus bound forms of chlorine. When calcium hypochlorite or sodium hypochlorite are used, the proper measure for residual chlorine is the amount of hypochlorous acid (HOCl) plus the amount of hypochlorite ion (OCl<sup>-</sup>). If one uses chlorine dioxide (ClO<sub>2</sub>) as a disinfectant, it is much more volatile, and basically all unreacted chlorine is really free. In that case, the free chlorine measure is a much better estimate of the residual chlorine than the sum of hypochlorous acid + hypochlorite ion. Because chlorine dioxide is more volatile, it leaves lower levels of residual chlorine per unit of oxidation / reduction potential than either of the hypochlorite salts. The volatility of chlorine dioxide also increases the risk of accidental releases.

Handlers, inspectors, and certifiers are all making different interpretations that chlorine can be measured only at discharge point from the line, at the waste water discharge point of the facility, or that any amount of chlorine can be used provided the product is rinsed with potable water. Indeed, a literal interpretation of the plain language of 205.605(b)(9) would lead a reasonable person to conclude that chlorine materials are to be used *only* for disinfecting and sanitizing food contact surfaces, and chlorinated water would be otherwise *prohibited* for direct food contact. The current situation allows non-uniform application of the NOP rule, and needs to be corrected by inserting the NOSB's original annotation language, and then by changing the Questions and Answers to provide uniform guidance.

We recognize that the produce and meat industries have invested heavily in chlorination technology to protect against food-borne pathogens. These food safety concerns are legitimate, and we affirm that organic food must meet all food safety requirements. However, chlorine does not appear to be federally mandated as the technology to meet anti-microbial requirements which instead require that pathogen reduction standards are met (for example, standards for raw poultry products in 9CFR 381.94 establish requirements for pathogen reduction, but do not mandate the use of chlorine). Often—as in the case of sprouts and fresh-cut salad—chlorine levels are mandated at the local or state, not federal level. Current federal guidelines for high levels of chlorination of seed used for sprout production are not mandatory, however microbial testing for safety of sprout products is being treated as a requirement subject to federal enforcement.

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<sup>1</sup> Bruno Langlais, David A. Reckhow and Deborah R. Brink, Ed., *Ozone and Water Treatment: Application and Engineering*, Chelsea, MI: Lewis Publishers Inc., 1991, pp. 30-31.

The TAP reviews pointed out many ways in which chlorine is unsatisfactory for organic handling. Chlorine compounds and other halogens have been shown to produce trihalomethanes. It was the NOSB's opinion that while chlorine needs to be allowed in the handling of organic food out of concern for public health and safety, its use needs to be minimized and operators need incentives and clear guidance to develop viable alternatives that protect the public as effectively as chlorine, but are less harmful to food handlers and the environment.

Toward that end, the NOSB has recommended other methods for disinfecting water in crop contact, including ozone, hydrogen peroxide, and periacetic acid. The review of chlorine should be prioritized in the re-review process in light of new information about alternatives, food safety, health effects, and application procedures. To the extent possible, the NOSB encourages the adoption of non-chemical and less toxic methods of disinfection of wash and chill water. This should be done with the full support and cooperation of the Food and Drug Administration's Center for Food Safety and Nutrition, and the Food Safety Inspection Service.

### III. Recommendations

- A. Change the annotation of §205.601(a)(2) to read: Chlorine materials - Except, That, residual chlorine levels in the water in direct crop or food contact and in flush water from cleaning irrigation systems that is applied to crops or fields shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act.
- B. Change the annotation of § 205.603(a)(3) to read: Chlorine materials - disinfecting and sanitizing facilities and equipment. Residual chlorine levels in the water in direct crop or food contact shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act.
- C. Change the annotation of § 205.605(b)(9) to read: Chlorine materials - ~~disinfecting and sanitizing food contact surfaces, Except, That,~~ residual chlorine levels in the water in direct crop or food contact shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act.
- D. Change the Questions and Answers to read:
  - Q. As a certified operator, at what point in crop, livestock or handling operations should I monitor for the maximum residual disinfectant limit?
    - A. Certified operators must monitor the chlorine level up stream of the wash operation or rinse operation, where the water last contacts the organic product. The level of chlorine in the water which last contacts the organic food products must meet the 4 mg/L limit as set forth by the Safe Drinking Water Act. A description of the operation's monitoring procedure is to be contained in the operation's Organic System Plan. Documents which demonstrate compliance are to be reviewed and verified during the operation's annual inspection.
  - Q. As a crop, livestock, or handling operation, am I restricted to use chlorine at the maximum residual disinfectant limit specified under the Safe Drinking Water Act, currently 4 mg/L, at the beginning of the wash/rinse water cycle?
    - A. No. Levels of chlorine used to prepare water to disinfect/sanitize tools, equipment, or food contact surfaces may be higher than 4 mg/L and should be at levels sufficient to control microbial contaminants. If water containing higher levels of chlorine comes in direct contact with organic crops or food products, there must be a final, thorough rinse with potable water.
  - Q. What is the "maximum residual disinfectant level?"
    - A. "Maximum residual disinfectant level" is a term defined by the Environmental Protection Agency (EPA) as the highest level of a disinfectant allowed in drinking water.

This level is currently established by EPA at 4 mg/L for chlorine. Practically applied under the National Organic Standards, the term “maximum residual disinfectant level” refers to the chlorine level of the water which last contacts organic products.

- E. The review of chlorine should be prioritized in the re-review process in light of new information about the relationship of chlorine and trihalomethanes, available alternatives, food safety, health effects, and application procedures.

**IV. Committee vote** – 5 in favor, 0 opposed, 2 absent.

**V. Minority opinion** – None.

**VI. Conclusion** – The NOP rule dropped all reference to direct contact of crops or food that was part of the original NOSB recommendation on chlorine. The original annotation language should be reinstated. The Questions and Answers on the NOP website should be re-phrased to focus on the monitoring of chlorine levels in water which contacts organic products, rather than on waste water which is discharged from the facility. Further, the review of chlorine should be prioritized in the re-review process in light of new information about the relationship of chlorine and trihalomethanes, available alternatives, food safety, health effects, and application procedures.

The NOSB Processing Committee acknowledges and thanks the Chlorine Task Force members who developed the draft language upon which this recommendation is based: Dr. Joe Montecalvo, Emily Brown Rosen, and Jim Riddle.