ENVIRONMENTAL ASSESSMENT

1. Date  
   July 12, 2016

2. Name of Applicant  
   Buckman Laboratories, Inc.

3. Address  
   All communications on this matter are to be sent to Counsel for Buckman,
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4. Description of the Proposed Action

   The requested action in this Notification is the establishment of a clearance to permit the use of monochloramine ("MCA" or the "FCS") for use as an antimicrobial agent in water used to process poultry. Specifically, the FCS is proposed to be used in both the primary and secondary processing of poultry. Primary processing includes spray and dip applications, both pre-chill and post-chill. Secondary processing applications include sprays and dips post-chiller and can include whole birds, parts, and pieces, and organs prior to packaging. In any single application the FCS will not exceed 50 ppm. MCA is intended to replace antimicrobials currently used in poultry processing plants, e.g., chlorine, peracetic acid.

5. Identification of Substances that are the Subject of the Proposed Action

   MCA (CAS No. 10599-90-3) is formed by the combination of ammonia and sodium hypochlorite. Specifically, MCA (NH₂Cl) is produced by combining 12.5% sodium hypochlorite (CAS No. 7681-52-9) with ammonium sulfate (CAS No. 7783-20-2) and ammonium hydroxide (CAS No. 1336-21-6). The resulting mixture is an alkaline solution of MCA and sodium sulfate in water. It is a colorless to yellow liquid that has a molar mass of 51.48 g/mol.

   Chloramines are a group of chemical compounds that contain chlorine and ammonia. MCA is the chloramine that is most widely used as a drinking water disinfectant.¹ The Environmental Protection Agency (EPA) estimates that one in five Americans use drinking water

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treated with chloramines. Chloramine (as Cl₂) concentrations up to 4 ppm are allowed for use in potable water by EPA and in bottled water by the Food and Drug Administration (FDA).

6. Introduction of the Food Contact Substance into the Environment

A. Manufacture

The Oxamine process is described in a confidential attachment to this EA. MCA is generated on site at the poultry plant where it is immediately fed to application points. Thus, the environmental impacts associated with the manufacture of the FCS are the same as those related to the use and disposal of the FCS.

B. Use/Disposal

Primary Processing: Primary processing is generally referred to as the processing of poultry from the time the live poultry enters the plant to the time carcasses exit the chillers. During primary processing, poultry carcasses are defeathered and eviscerated and are generally sprayed with chlorinated water, organic acids, or peracetic acid (PAA) through a railwater system and at various spray cabinets before being chilled via submersion baths. In this EA, Primary Processing refers to the use of MCA in the chiller baths and in the railwater system.

Chiller Baths: Generally plants have a “pre-chiller,” “main chiller,” and “finishing chiller” into which the carcasses are submerged for varying retention times. As shown in Figure 1 below, the chiller tanks are connected in such a way that water flows from the finishing chillers, where clean make-up water is added, to the main chillers, and then to the pre-chillers where it is then discharged into the plant’s onsite treatment facility.

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3 See 40 C.F.R. § 141.65(a).
4 See 21 C.F.R. § 165.110(b)(4)(H).
5 Unless otherwise indicated, the information contained in sections 6.B and 6.D describing poultry processing is based on Buckman’s knowledge of poultry processing operations.
The schematic was developed by Buckman based on its knowledge of poultry processing operations. Environmental Protection Agency regulations require poultry processing operations to treat wastewater onsite prior to directly discharging wastewater to surface waters under the National Pollution Discharge Elimination System. See generally, 40 C.F.R. 432. For those plants that send their wastewater to publically owned treatment plants, pretreatment is required. See generally, 40 C.F.R. Part 403.
MCA will be added to the poultry chillers at levels not to exceed 50 ppm. Although average MCA concentrations in each chiller will range from 15 to 25 ppm, for purposes of this assessment it is assumed that “worst case” concentrations of 50 ppm MCA will be maintained throughout the process. Poultry plant chiller operations may have up to four individual chiller tanks in a series ranging in size from 300 to 30,000 gallons per tank. Typically, however, a plant utilizes three chillers with the volumes specified in Table 2 below. Birds are fed into the chillers at a rate of approximately 90 to 140 birds per minute. Water is added to the chillers to maintain a high flow rate, making up for water lost through overflow and absorption, typically at a rate of 0.5 gallons per bird.

Railwater System: MCA will also be used in the railwater system at levels not to exceed 50 ppm to prevent cross-contamination. Water through the railwater system generally flows at a rate of 300 gallons per minute. Water from the railwater system drips off the equipment and carcasses to drains located throughout the plants. The drains all converge and flow to the onsite treatment facility.

Secondary Processing: Secondary processing generally refers to the further processing of carcasses after they leave the chillers. This may include such steps as cutting or deboning the carcasses. In secondary processing, there are up to 15 application points where the FCS aqueous solution could be sprayed on whole birds, poultry parts, and pieces, skin-on, skin-off and organs. The sprays are generally used to remove microbial contamination prior to and after the mechanical processing systems that debone, desinew, or defat poultry parts and pieces. The FCS aqueous solution would generally flow from the nozzles at a rate of 1 gallon per minute. These secondary systems may run continuously for 16 hours per day, similar to the primary processing operations. Water from secondary processing drains to locations throughout the plants that then go to the onsite treatment facility.

Thus, MCA treated water used during primary processing (chiller water and water from the railwater system) and from secondary processing become part of a plant’s total process water effluent that is treated by a wastewater treatment facility onsite. By volume, the MCA-treated water is a fraction of the total process water used at each plant.

C. Breakdown of MCA in the Poultry Process

MCA (NH₂Cl) is produced by combining bleach (sodium hypochlorite, NaOCl) with a solution of ammonia (NH₃) and ammonium ion (NH₄⁺). The resulting mixture is an alkaline solution of monochloramine and sodium sulfate in water.

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7 The maximum line speed under USDA’s New Poultry Inspection System is 140 birds per minute. 9 C.F.R. § 381.69.
8 See USDA, Food Safety Inspection Service Directive 6410.3, pgs. 3, and 14 (defining poultry chiller make-up water and noting that process control procedures for immersion chillers requires controls to maintain high flow rates, such as one-half gallon per bird), available at http://www.fsis.usda.gov/wps/wcm/connect/a4040350-16b1-4d29-b662-15200f943f51/6410.3.pdf?MOD=AJPERES.
9 Based on Buckman’s knowledge and experience, one gallon per minute is a typical flow rate.
10 As discussed in section 6.D, the total volume of MCA treated water is 507,900 gallons per day and the average poultry plant water use per day is over 1.8 million gallons. In many large plants, total water use may be as high as 3 million gallons per day.
When MCA is added to chiller water, the active chlorine atom (Cl\(^+\)) in monochloramine will either remain unchanged or will undergo one of four reactions described below. The extent to which each of these reactions will take place is dependent upon several factors, including pH, temperature, and the presence in the water of other species that could react with the MCA.

1. MCA can hydrolyze to form ammonia and hypochlorous acid (HOCl). The lower the pH, the greater the extent to which this reaction will proceed. In the pH range of the chiller water (pH 6-8), hypochlorous acid will be present as a mixture of HOCl and OC\(^-\); and ammonia will be present as ammonium ion (NH\(_4\)\(^+\)).

\[
\text{NH}_2\text{Cl} + \text{H}_2\text{O} + \text{H}^+ \rightarrow \text{NH}_4^+ + \text{HOCl}
\]

2. MCA can react with the oxidant demand in the chiller water and will be reduced to ammonia and chloride ion.

\[
\text{NH}_2\text{Cl} + 2\text{H}^+ + 2e^- \rightarrow \text{NH}_4^+ + \text{Cl}^-
\]

3. MCA can react with itself to form dichloramine (NHCl\(_2\)) and ammonia. The lower the pH, the greater the extent to which this reaction will proceed.

\[
2\text{NH}_2\text{Cl} + \text{H}^+ \rightarrow \text{NHCl}_2 + \text{NH}_4^+
\]

4. MCA can react with other amines (both ionic and nonionic) in the chiller water to form organochloramines. In other words, the active chlorine atom will be transferred from ammonia to an organic amine. There are many different organic amines in the chiller water that come from the chicken carcasses. One class of these organic amines would be amino acids, such as glycine, which could react with monochloramine to produce N-chloroglycine.

Accordingly, the final form in which the active chlorine atom of the MCA appears in the wastewater prior to on-site treatment could be any or all of the following: HOCl/OC\(^-\), NH\(_2\)Cl, NHCl\(_2\), Cl\(^-\), or an organochloramine. However, the wastewater discharged after treatment at the onsite treatment facility is monitored to determine if any active chlorine compounds (i.e., any compound containing Cl\(^+\)) are present. A total chlorine measurement (based on EPA standard methods for measuring residual chlorine in wastewater)\(^{11}\) is used to make this determination, and the water is dechlorinated to ensure that the water that is subsequently discharged from the onsite treatment facility contains no active chlorine compounds.

\(^{11}\) Typically, the n,n-diethyl-p-phenylene diamine (DPD) method (EPA Method 330.5) is used to measure residual disinfectant concentrations of chlorine, chloramines, and chlorine dioxide in water and wastewater. See EPA, Methods for Chemical Analysis of Water and Wastes, EPA No. 600/4-79/020 (March 1983); also available at http://www.caslab.com/EPA-Methods/PDF/EPA-Method-3305.pdf.
treatment system to the environment meets the discharge limits established by a facility’s National Pollution Discharge Elimination System (NPDES) permit. This total chlorine measurement will detect any compounds that contain active chlorine, including HOCl/OCr, NH2Cl, NHCl2, or an organochloramine. Any active chlorine that is detected in the wastewater is neutralized using a strong reducing agent like sodium bisulfite:

\[
\begin{align*}
\text{HSO}_3^- + \text{HOCl} & \rightarrow \text{SO}_4^{2-} + \text{Cl}^- + 2\text{H}^+ \\
\text{HSO}_3^- + \text{OCl}^- & \rightarrow \text{SO}_4^{2-} + \text{Cl}^- + \text{H}^+ \\
\text{HSO}_3^- + \text{NH}_2\text{Cl} + \text{H}_2\text{O} & \rightarrow \text{SO}_4^{2-} + \text{Cl}^- + \text{NH}_4^+ + \text{H}^+ \\
2\text{HSO}_3^- + \text{NHC}l_2 + 2\text{H}_2\text{O} & \rightarrow 2\text{SO}_4^{2-} + 2\text{Cl}^- + \text{NH}_4^+ + 3\text{H}^+ \\
\text{HSO}_3^- + \text{R-NHC}l + \text{H}_2\text{O} & \rightarrow \text{SO}_4^{2-} + \text{Cl}^- + \text{R-NH}_3^+ + \text{H}^+
\end{align*}
\]

Thus, no matter what form the chlorine the original MCA may have taken, it will be converted to chloride ion during treatment at the on-site treatment facility. Likewise, all of the ammonia/ammonium ion that was used to generate the original MCA will be converted back into ammonium ion during on-site treatment. The sodium ion and sulfate ion will pass through the entire system unchanged.

The ammonia will be broken down further in the on-site waste treatment process. The removal of nitrogen from wastewaters is a two-step process, beginning with nitrification and followed by denitrification. Nitrification, a microrganically mediated process, is also a two-step process, beginning with the oxidation of ammonia to nitrite and followed by the oxidation of nitrite to nitrate. Bacteria of the genus nitrosomonas are responsible for the oxidation of ammonia to nitrite; bacteria of the genus nitrobacter are responsible for the subsequent oxidation of nitrite to nitrate (EPA, 2004). Following the nitrification process under anaerobic conditions, nitrite and nitrate are reduced microbiologically by denitrification, producing nitrogen gas as the principal end product.

The “worst case” quantities of chloride, ammonia, sodium, and sulfate ions per pound of MCA used (assuming no breakdown of ammonia in the wastewater treatment process) that could be present in the final effluent – prior to treatment at the on-site treatment facility – are calculated in Table 1.
Table 1. Worst-Case Quantities of Chloride, Ammonia, Sodium, and Sulfate Ions Per Pound of MCA

<table>
<thead>
<tr>
<th>1.0 lb MCA</th>
<th>1 Mole MCA</th>
<th>1 Mole Cl⁻</th>
<th>35.45 lb Cl⁻</th>
<th>= 0.69 lb Cl⁻</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.48 lb MCA</td>
<td>1 Mole MCA</td>
<td>1 Mole Cl⁻</td>
<td>35.45 lb Cl⁻</td>
<td>= 0.69 lb Cl⁻</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.0 lb MCA</th>
<th>1 Mole MCA</th>
<th>1 Mole NH₃</th>
<th>17.03 lb NH₃</th>
<th>= 0.33 lb NH₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.48 lb MCA</td>
<td>1 Mole MCA</td>
<td>1 Mole NH₃</td>
<td>17.03 lb NH₃</td>
<td>= 0.33 lb NH₃</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.0 lb MCA</th>
<th>1 Mole MCA</th>
<th>1 Mole Cl⁻</th>
<th>1 Mole Na⁺</th>
<th>22.99 lb Na⁺</th>
<th>= 0.45 lb Na⁺</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.48 lb MCA</td>
<td>1 Mole MCA</td>
<td>1 Mole Cl⁻</td>
<td>1 Mole Na⁺</td>
<td>22.99 lb Na⁺</td>
<td>= 0.45 lb Na⁺</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.0 lb MCA</th>
<th>1 Mole MCA</th>
<th>1 Mole NH₄⁺</th>
<th>1 Mole SO₄²⁻</th>
<th>96.06 lb SO₄²⁻</th>
<th>= 0.93 lb SO₄²⁻</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.48 lb MCA</td>
<td>1 Mole MCA</td>
<td>1 Mole NH₄⁺</td>
<td>1 Mole SO₄²⁻</td>
<td>96.06 lb SO₄²⁻</td>
<td>= 0.93 lb SO₄²⁻</td>
</tr>
</tbody>
</table>

D. Expected Environmental Concentrations (EEC)

Based on Buckman’s experience and the range of data presented in Northcutt and Jones (2004), we estimate that the typical poultry processing plant processes 200,000 birds per day. On July 31, 2014, USDA finalized its “Modernization of Poultry Slaughter Inspection Rule” that did not increase line speeds to 175 birds/minute, as originally proposed. Instead, line speeds were maintained at a maximum of 140 birds/minute. For purposes of this analysis, it is assumed that a poultry processing plant operates two lines at the maximum line speed of 140 birds/minute over two shifts resulting in the production of 269,000 birds per 16-hour day.

Primary Processing

Operating Water: During the course of a 16-hour shift, MCA-treated water overflows from the last chiller tank on the line and would contain a worst case concentration of 50 ppm MCA. Based on a makeup water rate of 0.5 gallons per bird, a total of 134,500 gallons of water treated with MCA would be sent to the on-site treatment facility over the course of a 16-hour production day.

269,000 birds x 0.5 gal/bird = 134,500 gal/day FCS treated water

Chillers: As shown in Figure 1, poultry plants typically operate three chillers (a pre-chiller, a main chiller, and a finishing chiller). At the end of the 16-hour production day, water within each of the three chillers is drained and sent to the on-site treatment facility. The typical volumes of the chillers are set forth below in Table 2.

Railwater system: The railwater system that typically uses chlorine as an antimicrobial at levels of 20-50 ppm will be converted to MCA at a maximum level of 50 ppm. The average
water flow is approximately 300 gallons per minute during the 16-hour operation, all of which is discharged to the on-site treatment facility.

\[
300 \text{ gal/min} \times 60 \text{ min/hr} = 18,000 \text{ gal/hr FCS treated water}
\]
\[
18,000 \text{ gal/hr FCS treated water} \times 16 \text{ hrs/day} = 288,000 \text{ gal/day FCS treated water}
\]

**Secondary Processing**

As noted above, there are up to 15 application points where the FCS aqueous solution could be sprayed during secondary processing. FCS treated water from each application point flows at approximately 1 gallon per minute. For purposes of this EA, it is assumed that 15 application points are used yielding an average water flow during secondary processing of 15 gallons per minute during the 16-hour operation.

\[
15 \text{ application points} \times 1 \text{ gal/min} \times 60 \text{ min/hr} = 900 \text{ gal/hr FCS treated water}
\]
\[
900 \text{ gal/hr FCS treated water} \times 16 \text{ hrs/day} = 14,400 \text{ gal/day FCS treated water}
\]
The following calculation is used to determine the amount of MCA sent to the wastewater treatment system from primary and secondary processing operations:

\[
\text{Volume (gallons) } \times \frac{8.34 \text{ lbs./g}}{\text{MCA concentration (ppm)}} = \text{MCA lbs.}
\]

Table 2. Amounts of MCA Discharged to On-site Treatment Facilities Per Day

<table>
<thead>
<tr>
<th>Facility</th>
<th>Typical Volume (gallons)(^{12})</th>
<th>MCA Concentration (ppm)</th>
<th>MCA (total lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating water</td>
<td>0.5 gallons/bird (assuming 269,000 birds per day(^{13})) (total 134,500)</td>
<td>50</td>
<td>56.1</td>
</tr>
<tr>
<td>Two pre-chillers</td>
<td>10,000 per chiller (20,000 total)(^{14})</td>
<td>50</td>
<td>8.34</td>
</tr>
<tr>
<td>Two main chillers</td>
<td>25,000 per chiller (50,000 total)</td>
<td>50</td>
<td>20.85</td>
</tr>
<tr>
<td>Two finishing chillers</td>
<td>500 per chiller (1,000 total)(^{15})</td>
<td>50</td>
<td>0.42</td>
</tr>
<tr>
<td>Railwater System</td>
<td>288,000</td>
<td>50</td>
<td>120.1</td>
</tr>
<tr>
<td>Secondary Processing</td>
<td>14,400</td>
<td>50</td>
<td>6.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>507,900</strong></td>
<td></td>
<td><strong>211.81</strong></td>
</tr>
</tbody>
</table>

Thus, the total amount of MCA from the proposed use of the FCS sent to the on-site treatment facility is 211.81 lbs/day. The amount of chloride, ammonia, sodium, and sulfate ions generated as a result of the proposed use of the FCS is 146.15 lbs. (Cl), 69.9 lbs. (NH\(_3\)), 95.31 lbs. (Na), and 196.98 lbs. (SO\(_4\)), respectively. (e.g., 211.81 (lbs MCA) x 0.69 (Cl concentration per pound MCA))

It is estimated that the average poultry plant consumes a total of 26.0 L/bird or 6.87 gal/bird (26L/3.784 (number of liters per gallon)). (Northcutt and Jones, 2004). Assuming 269,000 birds are processed per day, the total daily water flow in the plant is 1,848,030 gallons.

\(^{12}\) Unless otherwise indicated, typical volumes are based on Buckman’s knowledge of the poultry industry.
\(^{13}\) See footnote 8.
\(^{14}\) Based on Buckman’s experience, pre-chillers range in size but are typically less than one-half the size of the main chiller. For purposes of this EA, a 10,000 gallon pre-chiller is assumed.
\(^{15}\) Based on Buckman’s knowledge of the poultry industry, finishing chillers range in size from 300 gallons to 1,000 gallons. For purposes of this EA, a 500 gallon finishing chiller is assumed.
per day (GPD) \((269,000 \times 6.87 \text{ gal/bird} = 1,848,030)\). To calculate the expected environmental concentrations (EEC), applying a FDA-accepted 10-fold dilution factor (Rapaport 1988), the following equation is used:

\[
\text{lbs of FCS}/(1,848,030 \text{ gallons x 8.34})/1,000,000 \times 10 = \text{ppm FCS}
\]

The resulting EECs are: chloride-0.95 ppm, ammonia-0.45 ppm, sodium-0.62 ppm, and sulfate-1.27 ppm.

Assuming MCA is not broken down and not dechlorinated prior to discharge, the worst case EEC for MCA would be 1.37 ppm. The EEC for ammonia would be worst case as well. As explained in Section C above, the majority of the ammonia will be consumed in the on-site treatment process by nitrification and denitrification prior to discharge.

7. **Fate of Substances Released into the Environment**

Based on the calculations detailed above, because MCA is broken down in the poultry process to chloride ion, ammonia, sodium ion, and sulfate ion, the following EECs represent the worst-case concentrations that may be discharged from a POTW or an on-site wastewater treatment system:

<table>
<thead>
<tr>
<th>Substance</th>
<th>EEC (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloride</td>
<td>0.95 ppm</td>
</tr>
<tr>
<td>Ammonia</td>
<td>0.45 ppm</td>
</tr>
<tr>
<td>Sodium</td>
<td>0.62 ppm</td>
</tr>
<tr>
<td>Sulfate</td>
<td>1.27 ppm</td>
</tr>
</tbody>
</table>

If MCA is not broken down in the poultry process and not dechlorinated prior to discharge, as noted, the worst case EEC would be 1.37 ppm. To validate the breakdown of MCA and determine whether MCA may be released to the environment, Buckman sampled the influent to the on-site treatment facility at a poultry processing plant that was using MCA in its chillers at a maximum concentration of 50 ppm on a trial basis under USDA and FDA interim allowances. Consistent with the assumptions detailed above, the trial plant operated two lines over a 16-hour production day producing 177,000 birds per day with an average annual water flow from a plant of 3.0 million gallons per day.

Influent going to the on-site treatment facility was sampled for MCA using the Hach Monochlor F Method that is specific for measuring monochloramine in drinking water and chlorinated wastewater. The level of detection is 0.04 ppm. Twenty-five samples were collected over a two-week period. MCA was not detected in the influent at the detection limit.\(^6\) The data validate that MCA will be broken down in the poultry and waste treatment processes and therefore MCA would not be discharged to the environment. Although not sampled, the low levels of ammonia potentially present in the influent would be consumed in the on-site treatment process and therefore would not be discharged to the environment.

\(^6\) The data are presented in Attachment B.
8. Environmental Effects of Released Substances

As discussed above, low levels of chloride, sodium, sulfate, ammonia, and MCA may be discharged to the on-site treatment facility. However, neither ammonia nor MCA is expected to survive treatment.

Discharge to Water

Chloride: The maximum level of chloride that may be discharged to the environment is 0.95 ppm. Pursuant to section 304(a) of the Clean Water Act, EPA has established water quality criteria for chloride of 860 mg/L for acute toxicity and 230 mg/L for chronic toxicity based on data available for 12 different species (genus). (EPA, 1988). An EEC of 0.95 ppm is a small fraction of the water quality criteria.

Ammonia: Even assuming that ammonia survives wastewater treatment, the maximum level that could be discharged to a water body would be 0.45 ppm. This level is below EPA’s current acute and chronic Ambient Water Quality Criteria for Ammonia. (EPA, 2013).

Sodium: Freshwater is defined by the U.S. Geological Service as water containing less than 1,000 mg/L of dissolved solids, most often in the form of sodium. (USGS, 2014). The EEC sodium level is well within freshwater sodium concentrations.

Sulfate: EPA has not established a water quality criterion for sulfate. However, the State of Iowa worked with EPA to develop a criterion based on available toxicity data for 11 species. The criterion varies in relation to background hardness and chloride levels, ranging from 500 to 2,000 mg/L. (Iowa Administrative Code, Chapter 61). The EEC for sulfate is well below the criterion.

MCA: As demonstrated above, MCA is consumed and broken down to chloride, ammonia, sodium, and sulfate though the poultry process and Buckman’s analysis demonstrated that MCA was not detected above the level of detection (0.04 ppm). Even if MCA survived the poultry process, the on-site treatment facility would dechlorinate any MCA that may be present in accordance with its NPDES permit to levels that are acceptable for aquatic life. Moreover, MCA is allowed in drinking water at levels of 4 mg/L which is freely discharged to water bodies.

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17 EPA’s acute criterion is 17 mg/L at pH 7 and 20°C for a one-hour average duration, not to be exceeded more than once every three years on average. EPA’s chronic criterion is 1.9 mg/L at pH 7 and 20°C for a 30-day average duration, not to be exceeded more than once every three years on average. In addition, the highest four-day average within a 30-day period should not exceed 2.5 times the chronic criterion magnitude (e.g. 1.9 mg TAN/L x 2.5 = 4.8 mg TAN/L at pH 7 and 20°C) more than once in three years on average.


19 EPA notes that many aquatic toxicity values for chlorine are less than or equal to 1 mg/L. Twenty-four-hour LC50 values range from 0.076 to 0.16 mg/L for Daphnia magna (water flea) and from 0.005 to 0.1 mg/L for Daphnia pulex (cladoceram; 48-hour LC50 values range from 5.3 to 12.8 mg/L for Nitocra spinipes (snail); and 96-hour LC50 values range from 0.13 to 0.29 mg/L for Oncorhynchus mykiss (rainbow trout), from 0.1 to 0.18 mg/L for Salvelinus fontinalis (brook trout), and from 0.71-0.82 mg/L for Lepomis cyanellus (green sunfish). See EPA Chemical Summary for Chlorine, August 1994, available at http://www.epa.gov/chemfact/s_chlori.txt.

20 See 40 C.F.R. § 141.65.
Land Application

Based on Buckman’s experience, some plants may discharge their wastewater after treatment via overhead irrigation to land, typically under a state permit. The wastewater is not applied to crops and typically must be operated as a “no discharge system” meaning that the application rate cannot exceed the amount of water that can be handled by the field. In addition, groundwater leaving the land application system boundaries cannot exceed maximum contaminant levels for drinking water.

Chloride: Chloride is a critical component in the metabolic process of plants and is highly soluble and mobile. The EEC for chloride from this proposed use is 0.95 ppm, which is a small fraction of the water quality criteria for chloride (860 mg/L acute toxicity; 230 mg/L chronic toxicity) and the secondary maximum contaminant level for public water systems of 250 mg/L. Turf grasses can tolerate chloride levels up to 100 mg/L and may sustain injury when irrigated with water containing more than 355 mg/L of chloride. (Landschoot, Penn State Plant Science). The EEC for chloride is far below these levels.

Ammonia: As noted above, ammonia is not likely to survive wastewater treatment. However, if ammonia was present in wastewater applied to land it would further volatilize during the land application process. Studies show that the average ammonia loss from volatilization ranges from 15 to 35% (averaging 22%) over 2-hour periods. (Saez, J.A. 2012). Soils have been reported to have background concentrations of ammonia ranging from 1 to 5 ppm. Water quality guidelines for agricultural irrigation water indicate that the usual range of ammonia (measured as NH₃-N) in irrigation water is 0 to 5 mg/L. (Ayers, R. S. 1994). The EEC for ammonia is within the usual range for agricultural irrigation water.

Sodium: Sodium exists in nearly all irrigation water and is not a cause for concern unless it is in concentrations greater than 70 mg/L. (Landschoot, Penn State Plant Science). Sodium concentrations in soil and other surficial materials in the U.S. range from less than 500 ppm to more than 100,000 ppm. (EPA, 2003). Sodium levels of 50 ppm or less are considered acceptable for overhead irrigation. (Will, et al., Univ. Tenn.). The EEC is far below the levels that could impact soil or turf grasses when applied in irrigation water.

Sulfate: Sulfate is relatively common in irrigation water and has no major impact on soil, other than contributing to overall salinity. Sulfate levels in irrigation water range from 0 to 20 milliequivalents per liter. (Ayers, R. S. 1994). Soils are thought to average 850 mg of sulfate/kg. (USDA). The EEC level of 0.82 ppm is well within the desirable range.

MCA: As discussed above, MCA is consumed and broken down to chloride, ammonia, sodium, and sulfate though the poultry process. As noted above, even if MCA survived the poultry process, the on-site treatment facility would dechlorinate any MCA that may be present in accordance with its NPDES permit to acceptable levels. Chlorine is a plant micronutrient.

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21 Buckman is not aware of any study demonstrating that MCA will partition to sludge. This is expected because as discussed in section 6.C, MCA is readily broken down, especially in poultry processing. Buckman’s analysis of the on-site wastewater treatment influent demonstrated that no MCA was detected above the level of detection, thereby confirming the breakdown of MCA. Thus, only EECs for discharge to surface water are needed.
Chloramine levels allowed in drinking water (4 mg/L) have not been shown to adversely impact plants or soil.

9. **Use of Resources and Energy**

The use of MCA is not expected to result in an increase in the use of energy or resources, as it is an alternative form of chlorine currently in use. Energy used for the production of MCA on site through the Oxamine process is insignificant.

10. **Mitigation Measures**

As shown above, there are no adverse environmental effects associated with the use of the MCA. Thus, the use of MCA is not expected to result in any new environmental issue that would require mitigation.

11. **Alternative to the Proposed Action**

No potential adverse environmental effects are identified herein that would necessitate alternative actions to that proposed in this Notification. The alternative of not allowing the use of MCA would result in the continued use of other products, e.g., chlorine, by poultry plants. MCA is a promising technology for poultry processing plants that would improve food safety and decrease the discharge of chlorides to the environment.

12. **List of Preparers**

1. Hank Howell  
   Director of Technology and Business Development  
   Buckman Laboratories  
   35 years’ experience in industrial chemistry, including poultry processing

2. Geraldine Edens, Ph.D., J.D.  
   Partner  
   Baker & Hostetler LLP; Counsel to Buckman  
   25 years’ experience practicing environmental law
13. Certification

The undersigned official certifies that the information provided herein is true, accurate, and complete to the best of her knowledge.

Dated: July 12, 2016

Geraldine Edens
Counsel for Buckman Laboratories, Inc.
14. REFERENCES

Ayers, R. S., Water quality for agriculture, United Nations, Food and Agriculture Organization, Chapter 1.4, Table 2 (1994).


Iowa Administrative Code, Chapter 61.


15. Attachments

A. Confidential Manufacturing Information
B. On-site Wastewater Treatment Influent Sample Data for MCA