

IOA/PAG FOOD/AG TREATMENT TASK FORCE

CASE STUDY DATA REPORT

TITLE: BULK STORAGE AND CURING OF ONIONS – A West Coast onion grower, 2003 crop

A. DESCRIPTION OF THE PROBLEM

Onions classically have been bagged in the field and left there to cure. This method is labor-intensive, and recent approaches have been to store bagged onions in covered storage bins. Bulk storage prior to bagging could further decrease labor costs. However, bulk storage increases problems caused by storage diseases. If storage of onions in an ozone-containing atmosphere can mitigate the effects of storage diseases, considerable savings can accrue to the onion farmer.

At this particular West Coast onion growing facility, 240,000 bags of onions from the 2003 crop were stored in a single shed. Of these, 158,500 bags came from a single field. An estimated 30% of the 158,500 bags were contaminated with decay and neck rot that could not be detected on the sorting table. Based on past experiences, only 20-30% of these bags would result in marketable onions, at best, but the entire stored volume of onions might have been lost had nothing been done to change the expected outcome.

Ozone was applied to the onions as they were sent into the storage shed, as well as during storage (see below). Mold could not be stopped growing on contaminated onions, but ozone treatment did prevent the spread of mold to good onions. Consequently, some 60-65% of the stored crop was marketable after ozone treatment and storage.

B. DESCRIPTION OF PLANT OR PROCESS

Onions are mechanically harvested, and brought to storage in bulk trucks with belt unloading. The onions are unloaded onto a machine where dirt, debris, and damaged or spoiled onions are removed. The onions are then conveyed into the storage building on conveyor belts and piled into storage. One of the conveyors (the O3Zone Tunnel) is provided with a cover to contain the ozone in that flow of onions contained within workers are not concentrations Tunnel are



conveyor and allow an uneven to pass through. The ozone is the O3Zone Tunnel so that exposed to ozone. Ozone in the O3Zone conveyor maintained above 300 ppm.

Once the onions are placed into storage, ozone then is applied through the ventilation system to maintain a low concentration of ozone (about 1 ppm) surrounding the onions throughout the storage period. The premise is to reduce significantly the pathogen population on the onions going into storage (by exposure to ca 300 ppm of ozone for 15-30 seconds) and then keep the pathogens under control during storage with ozone at about 1 ppm. The storage ozone concentration is low so that no damage occurs to the onions, yet is high enough to keep the pathogens under control.

C. DETAILS OF OZONE SYSTEM AND APPLICATION

A single ozonation system, manufactured by the O3Co (Aberdeen, Idaho, USA) provides ozone for (first) the conveyor O3Zone Tunnel during transfer of onions into storage, and (later) for treating the storage atmosphere. Ozone is prepared from ambient air dried to - 65EF dew point, and is produced at concentrations of about 1.7 % by weight. Application is controlled and modified in terms of grams per hour of applied ozone. In the O3Zone Tunnel, onions are exposed to ca 300 ppm of ozone for 15-30 seconds. During bulk storage, onions are exposed to about 1 ppm of ozone for months. Ozone is applied continuously during storage, but the supply is shut off for 2-3 hours every 2-3 days to allow the stored onions to be examined as desired.

D. CASE STUDY INFORMATION

Had the contents of the storage shed not been treated with ozone and had been lost to mold growth during storage, the loss in marketable onions would have amounted to a value of about \$750,000. Had only the lot from the single field been lost to rot, the market value would have been about \$300,000. Without ozone treatment, only some 30% of the 158,000 bags (47,550 bags) of onions were expected to be marketable.

Instead, ozone treatment resulted in *an additional* 55,500 bags of onions being marketed at *an additional* income of \$166,500.

The O3Co Ozone Tunnel cost \$116,000, including ozone generation and control equipment. The income realized from the additional 55,000 bags of onions, saved by ozone storage, was \$166,500, meaning that this extra income alone more than paid for the ozonation equipment, which is being used on subsequent crops of stored onions.

E. EMPLOYEE HEALTH & SAFETY ISSUES

SAFETY FEATURES OF THE O3ZONE TUNNEL

The O3Zone Tunnel is fitted to the customer's portable conveyor, 30," 36" or 42." O3 Co furnishes a cover composed of sections that are clamped on the conveyor and sealed with foam sealing strips and the joints are caulked. The ozone is contained in the Tunnel by means of an air lock system on each end of the tunnel composed of two sets of special brushes spaced 18" apart. The brushes are free to follow the irregular shape of the top of the produce on the conveyor. Ozone that leaks passed the first set of brushes is trapped between the two sets of brushes. A

slight vacuum is maintained between the brush sets on the discharge end by the off-gas blower. The off-gas blower system removes any ozone that leaks past the first set of brushes and discharges it either into the storage air plenum then into the onion pile, or away from any people.

Ozone sometimes is carried out of the air lock between the produce, and the ozone concentration downstream near the conveyors may reach or exceed the maximum recommended OSHA workplace concentration of 0.10 ppm. An ozone sensor is placed downstream so it will sense and signal when ozone has reached concentrations above the OSHA safe standard where people are working. When this condition occurs, a blower on the discharge end is turned on and remains on until the ozone concentration has dropped below the OSHA recommended level.

The ozone concentration is monitored in the Tunnel, and when the concentration reaches a set point slightly above the desired operating concentration, the CT2000 controller begins shutting down ozone generating chambers. The automatic shutdown continues until the ozone concentration drops to the selected operating concentration or all chambers are off. When the ozone concentration drops below the lower set point, all chambers are turned back on.

Each O3 Zone Tunnel system is supplied with a hand held ozone monitor so that the ozone concentrations can be monitored where people work. Corrective action can be taken that will ensure safe ozone concentrations exist where people work. The only location on an O3Zone Tunnel system where ozone concentrations have been observed above the OSHA safe concentration of 0.10 ppm is immediately after the discharge from the tunnel. Ozone concentrations above 0.10 ppm have never been observed beyond 20 feet of the tunnel discharge.

In the event ozone concentrations above 0.10 ppm are observed in the storage building, an exhaust ventilation fan can be turned on for a short time to clear the ozone from the storage where people are working.

The electrical power to the ozone generator can be turned off in an emergency with the main disconnect outside the trailer in the unlikely event that large concentrations of ozone occur.

A portable ozone monitor (Porta Sense) is supplied with each system. It is recommended that ozone concentrations be monitored in areas where people are working. If the ozone concentration becomes higher than the maximum OSHA safe level of 0.10 ppm, corrective action should be taken: 1) Move the people to a work station where ozone concentrations are safe; 2) place fans so the ozone can be blown away from the people; 3) under extreme conditions, shut off the ozone generator.

F. ADDITIONAL COMMENTS

G. SUBMITTER – JOB TITLE – CONTACT DETAILS

Lynn Johnson, President, O3Co. lynn@o3co.com. Steve Smith sswenthunting@pocketinet.com

H. REFERENCE(S) – ARTICLE(S) – AS APPROPRIATE
www.O3Co.com;

