



Department of Pesticide Regulation



Mary-Ann Warmerdam
Director

MEMORANDUM

Arnold Schwarzenegger
Governor

TO: George Farnsworth
Environmental Program Manager I
Worker Health and Safety Branch

HSM-10003

FROM: Harvard R. Fong, CIH *(original signed by H. Fong)*
Senior Industrial Hygienist
Worker Health and Safety Branch
916-445-4211

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SUBJECT: OBSERVATIONS AND RECOMMENDATIONS FROM AN OCTOBER 27TH
EVALUATION OF A COMMODITY PROCESSING FACILITY INVOLVED IN
A PRIORITY ILLNESS EPISODE IN SAN BENITO COUNTY

On October 27th, 2009, I traveled to San Benito County to conduct a workplace evaluation of a commodity processing facility, Earthbound Farm (Earthbound). This facility had experienced a suspected pesticide exposure event to 17 workers that required medical attention. The exposure event occurred on September 15th, 2009. Because of an unfortunate situation at the local County Agricultural Commissioner's (CAC) office, a timelier visit to the facility was not possible.

I met with representatives of Earthbound and also of the company responsible for the installation of a new chlorine dioxide generator for water treatment, AquaPulse Systems (APS). We initially met in the facility's conference room to discuss the event. Earthbound and APS staff explained their understanding of what happened and how the chlorine dioxide system, brought on-line on September 15th, may have played an indirect part in the event. Earthbound deals in "organic" produce and as such, is required to use only specific "organic" pesticides (sanitizers et al.) as defined in Title 7 Code of Federal Regulations Part 205.601. Several chlorine compounds are covered by this regulation, including ones used by Earthbound.

As explained to me, the chlorine dioxide (ClO₂) system is a recent addition to the water supply of the facility. Earthbound uses well water drawn from fields adjacent to the processing plant. This water is treated, originally by liquid chlorine (sodium hypochlorite) injection and sand filtration. The ClO₂ system replaced the liquid injection system. The reasons for the change included better efficacy and problems with trihalomethane (THM) formation under the old system. The local water quality agency had warned Earthbound of excess THM in their wastewaters. A ClO₂ system does not form THMs to the extent that a sodium hypochlorite system can. The water treatment site is located more than 200 feet from the production facility and does not appear to have any connection to the production facility other than treated water lines. Water is stored at the treatment site in two 97,000 gallon tanks. The entire treatment site area was well maintained and enclosed by a metal fence.



The ClO₂ system generates gas using three precursor chemicals: sodium chlorite (registered product “ADOX 8125”), sodium hypochlorite (registered product “AQUA CHLOR 12.5”) and hydrochloric acid (muriatic acid). These precursors are combined in a small reaction chamber and injected, via a venturi-type system, into the water supply. The ClO₂ system was brought fully on-line for the domestic water supply on the day of the illness event. This domestic supply water, treated with ClO₂ to about 0.75 parts per million (ppm) chlorine residual, is used throughout the facility for both drinking water and other water uses, including water for sanitizing equipment. It is fully potable. This water is also used in the water flumes for produce transport. The flume water, also called production water, has a target residual ClO₂ of 2 ppm. However, the 2 ppm value had yet to be established as an acceptable alternative to their standard flume water treatment, which was manual addition of hypochlorite to the flume for a chlorine level of between 10 and 20 ppm, using colorimetric titration to monitor chlorine in the flumes. The boosting of the domestic water to 2 ppm for production is done at the same site as the domestic water is treated. There is no separate site for water boosting. The boosted water runs in its own lines, separate from the domestic water lines, and is stored in 8,000 gallon tanks located by the employee entrance.

According to the Earthbound staff, initially five employees reported a chemical smell they had not previously encountered in the facility. Of these five, four were sanitation crew and one was a production line worker. Since the facility has to be sanitized daily, there is a special crew-shift that comes on between production shifts and sanitizes the entire facility, including processing equipment. Sanitizing agents used at the facility include inorganic alkalines (sodium hydroxide, potassium hydroxide); acids (nitric acid, phosphoric acid, peroxyacetic acid); hydrogen peroxide; ethylene glycol monobutyl ether and lauryl dimethylamine oxide. In most cases, domestic water supply is used as the diluent for these materials. On the day of the event, the sanitation crew was finishing their shift and production line workers were beginning to come into the processing facility. At approximately 1700 hours, the initial five employees reported feeling ill from a chemical smell. At 1710 hours, electrical power to the processing facility was lost. At 1715 hours, the facility was evacuated. By 2000 hours, the Department of Forestry (DoF), which because there is no local fire district jurisdiction, is the designated responding agency, had arrived and begun triage and incident evaluation/control. According to Earthbound, the triage relied heavily on employee-reported detection of “unknown chemical” odor. Twelve more employees were identified by DoF personnel as being exposed or ill.

A workplace evaluation of the facility did not reveal any obvious potential sources of pesticide exposure. As mentioned earlier, Earthbound is an “organic” processing facility, and as such is constrained as to what pesticidal materials may be used for sanitizing, disinfecting, inhibiting fungal growth and controlling vermin and other pests on produce or in the facility. The materials I saw in use were soaps and chlorine baths. The previously listed materials are the active ingredients from the sanitizer labels provided by Earthbound.

A phenomenon often associated with the initial switch of water distribution systems from hypochlorites and gas chlorine to ClO_2 is the sloughing off of biofilms within the conduits of the system. Biofilms are an "...aggregate of microorganisms in which cells are stuck to each other and/or to a surface. These adherent cells are frequently embedded within a self-produced matrix of extracellular polymeric substance (EPS). Biofilm EPS, which is also referred to as "slime," is a polymeric jumble of DNA, proteins and polysaccharides. Biofilms may form on living or non-living surfaces, and represent a prevalent mode of microbial life in natural, industrial and hospital settings." (Wikipedia, key word "biofilm").

The use of ClO_2 causes the biofilms lining the conduit to dislodge. The sloughing off effect was also mentioned by the APS representative, who further stated that the dislodged biofilms may be odiferous and may temporarily cause a faint color change (blue to blue/green) in the water. Prior to the full scale use of ClO_2 , water treated with ClO_2 was flushed through the lines that had supposedly been equipped with filters at the ends, to capture dislodged biofilms. However, there was apparently no such action for end-use devices that would connect to the cleared distribution lines, e.g. hoses used for washing down the equipment. The cleaning crew's hose trolleys I observed were equipped with very long hoses (Photo One).



Photo One: Hose Trolley

These hoses were apparently not pre-flushed with ClO_2 before being attached to the domestic water system that was now changed over (and pre-flushed) to ClO_2 . Use of these hoses, and any other such system that had long hoses that had not been pre-flushed, could have resulted in

contact and attachment of sloughed biofilm on the clothing of the workers. Workers would not be expected to unduly avoid contact with the materials from these devices, since they were expected to be water and “organic” sanitizing solutions (essentially soaps, dilute alkalines and acids and chlorinated compounds), materials not unlike what they would use for cleaning at home. Thus it is not unreasonable to assume that workers may have been “contaminated” with biofilm.

A second indication of biofilm involvement comes from reports from some of the workers who were evacuated from the facility that the odor seems stronger outside. According to weather records for the area, the outdoor temperature at 1900 hours was about 60° F (16° C). Exiting the colder interior environment (~35° F / 1° C) would have allowed the more volatile components of the biofilm to readily vaporize, potentially increasing its odor. This could explain the reports of stronger odor after evacuation.

After assessing and reviewing the information available from Earthbound staff, APS staff, on-site evaluation and in-house research, I believe the following observations and recommendations should pertain to this event:

- There does not appear to be a pesticide-exposure event in the normal sense. Though there was (and still is) exposure to ClO₂ in the water, there did not seem to be any indication of excessive or uncontrolled exposure to this material via the domestic water supply system. Chlorine compounds are a necessary component to most water supply systems, suppressing water-borne pathogenic organisms.
- However, the introduction of ClO₂ into the domestic system may have been the precipitation agent that resulted in worker illness.
- By causing a sloughing off of biofilms in delivery lines that had not been pre-flushed into filters, the ClO₂ may have exposed workers to biofilms and other materials that had been embedded in them. This may have resulted in workers inhaling odiferous and offensive or otherwise unexpected vaporized materials. These materials, in and of themselves, may be of low toxicity, but were reacted to by the workers as harmful agents, resulting in worker illness. Toxicity alone is not the sole indicator of potential illness. Physiological reaction to offensive odors is a legitimate cause of illness.
- In future conversion events, end-use devices that have appreciable hose lengths should be included in the initial system flush.
- In situations such as this, where a new pesticidal material is being brought online, all employees should be informed of the change over. Apparently only management and

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supervisors were notified. Granted, nothing was expected to happen in the change-over of water disinfectant agents and steps had been taken to eliminate biofilm exposures. However, in such situations, it would be best practice to notify all workers potentially in contact with the domestic water (in this case, everyone). Workers who are informed that a new material is coming into the workplace will be able to better understand if an unexpected event occurs. This recommendation is the most important item in consideration of future pesticide-related events. An informed workforce can appropriately react, whereas employees who are not notified may react in random and apprehensive ways.

cc: Ron Ross, San Benito County Agricultural Commissioner
Karen Francone, Enforcement Branch, Central Regional Office
Jose Bueno, Enforcement Branch, Central Regional Office