

White Powder Deposits on Food Cargoes

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White powder deposits (aluminum oxide/hydroxide) have been reported on food cargoes carried in refrigerated containers.¹ The white powder has been a source of customer rejections, lost transportation revenues, claims and government mandated destruction of the food cargoes. Although no short term “fix” will completely solve the corrosion related problems, there are a number of actions that can be adopted that will help mitigate recurrence of the corrosion induced white powder.

Accordingly, the following actions are suggested to help prevent corrosion induced white powder deposits on food cargoes carried in refrigerated containers:

1. Establish, publish and implement operational guidelines and policies that:
 - a. Require all parties to wash (clean) the interior of refrigerated containers with heated fresh water² with no corrosive cleaning agents that will damage the refrigerated containers or the environment³. Cleaning methods have their own advantages and disadvantages that should be considered in the light of the circumstances of each case. With regard to corrosion, we suggest a neutral pH wash solution. One method to clean the interior

¹ **Warning - unless the white residue can be instantly identified it should be “treated as hazardous until proven otherwise”.** If any doubt exists about the identification of a cargo residue or any unknown substance inside a container a sample should be taken for analysis. The taking of samples should be done in a controlled manner, by an authorized person wearing appropriate personal protective equipment such as respiratory protective equipment and impervious gloves. Once the residue in a container is identified, the container operator should appoint a cleaning contractor who has the experience and facilities for the proper cleaning and disposal of the residue.

² Refer to the US 2013 FDA Food Code for guidance concerning the temperature tolerances of wash solutions in spray type washers and other types of equipment that use hot water to clean and sanitize surfaces.

³ Refer to OEM cleaning parameters and the United States Department of Agriculture (“USDA”) for published performance standards specifying what cleaners should be utilized for specific tasks. Products should be labeled: “This Product Meets USDA Performance Standards for (A-1) Type Products.”

surfaces of a refrigerated container would be with a heated fresh water broad spray pressurized system of 2000-2500 psi (steam cleaning) without a corrosive cleansing solution. Care must be taken not to damage evaporator coil fins, electrical connections and thermal tape with the pressurized water stream. During and after washing the container, the container should be parked so the rear (door end) of the container slopes downwards to completely drain the container. The interior of the container should be dry before the rear doors are closed. Moisture when mixed with some fumigants facilitates oxidation of the aluminum alloys. The four floor drains (two forward and two aft) should always be thoroughly cleaned of all debris prior to and after washing the container. Refer to company policies and equipment manufacturer's guidelines for the cleaning methodologies and the intervals of cleaning. Company policy should specify maintenance cleaning guidelines and training requirements for personnel and/or agents who are accountable for properly cleaning refrigerated containers.

- b. Rinse the interiors of containers with a heated fresh water broad spray nozzle pressurized system of 2000-2500 psi after sulfur dioxide ("SO₂") treated cargoes have been shipped in them.⁴
- c. Discontinue in-container insect disinfestation with fumigants like methyl bromide.
- d. Require suppliers and shippers to eliminate the practice of exogenously adding SO₂ gas into the interior cargo space of refrigerated containers at the time of loading table grapes and other cargoes. Sulfur dioxide is an intermediate in the production of corrosive sulfuric acid. Sulfuric acid is a highly corrosive acid.
- e. Consider not shipping cargoes like lychees and longans if the shipper insists on applying excessive amounts of sulfur dioxide.
- f. Clean the stators and other corroded parts with a fully biodegradable and environmentally safe cleaning agent. In the December 2010 TECHLINE bulletin, Carrier recommends Tri-

⁴ Refer to US FDA Food Code and OEM guidance for temperature tolerances for the fresh water.

Pow'r® HD to assist in helping to remove the corrosive fumigation chemicals and dislodging of the corrosive elements.

- g. Encourage shippers to specify at the time of booking that the fresh air exchange be opened to 25 cbm (15 cfm) for grape shipments using slow and fast release in-package SO₂ generators to suppress the growth of *Botrytis* mold. It should be noted that some exporters specify a closed fresh air exchange for table grapes at the time of booking.
2. When identifying a container for the movement of high-risk cargoes/shipments where outturn inspections may result in the rejection and possible mandated destruction of cargo, turn-off the refrigeration unit and unplug the unit from its electric power source. After the unit is turned-off, remove the exterior evaporator fan cover plates to determine if serious corrosion issues exist on aluminum alloy/metal components such as stators, fans, and the like. A corrosion problem, if present anywhere, should either be corrected or a different refrigerated container without serious corrosion issues could be deployed and dispatched.
3. Minimize the corrosion attack of existing units on aluminum alloy stators by using replacement housings fabricated from materials exhibiting better corrosion resistance or, as an alternative, treat existing stator housings with corrosion resistant coatings such as marine grade epoxy paints.
4. Conduct appropriate tests and inspections of the refrigeration units and container boxes to assure that adequate precautions have been taken to avoid galvanic corrosion when dissimilar metals come in contact.
5. Update and implement, as needed, new US Food and Drug Administration (“FDA”) regulations such as “shipper” specified interior refrigerated container cleaning instructions and processes involving the Sanitary Food Transportation Act and the Food Safety Modernization Act.⁵ The new rules address, in part, risks to human or animal health

⁵ The U.S. FDA final rule establishes requirements for shippers, loaders, carriers by motor vehicle and rail vehicle, and receivers engaged in the transportation of food to use sanitary transportation practices to ensure the safety of the food they transport. The rule ensures, in part, that any question relevant to whether the food may be adulterated is adequately addressed before the shipment is allowed to proceed

associated with the transportation of food. With regard to refrigerated container sanitation and food safety, the central question is “how clean is clean” with respect to the refrigerated container and the refrigeration unit. Are the refrigerated containers physically clean, chemically clean and/or microbiologically clean?

6. For future refrigerated container acquisitions, it is recommended that refrigerated container design and performance specifications be published that take into full account the reality that the interior of refrigerated units and containers will most likely be subjected during the normal course of a refrigerated container's life to moisture and corrosive agents like cleaning solutions, fumigants such as methyl bromide and SO₂ (i.e. in-package SO₂ generators, exogenous applications of SO₂) and sulfur compounds emitted from vessel and truck stack gases (when the fresh air exchange is open). Refrigerated container designs could include safeguards that prevent or suppress corrosion such as coatings, corrosion resistant aluminum alloys and the like.

in U.S. commerce. It is unlawful to introduce or deliver for introduction into interstate commerce any food that is adulterated. Further, even in cases where there is a foreign shipper, that shipper may be working in conjunction with a U.S. freight broker that could be contacted in its place to evaluate whether the food is unsafe. Moreover, if the freight broker (or others) has arranged the U.S. land-based transportation leg of the foreign shipment, the broker is the legally responsible “shipper” for purposes of the rule and therefore subject to the applicable requirements of the rule including the requirement to specify to the carrier the conditions necessary to ensure the safe transport of the food.