

Program Information Manual Retail Food Protection: Recommendations for the Temperature Control of Cut Leafy Greens during Storage and Display in Retail Food Establishments

Background

The 2009 Food Code identifies cut leafy greens¹ as a food that requires time and temperature control for safety, or a TCS food. Therefore, the provisions of the 2009 Food Code that apply specifically to TCS foods apply to cut leafy greens.

Cut leafy greens were designated as TCS food because they provide a medium that readily supports the growth of pathogens when they are held without temperature control after the internal fluid and nutrients are exposed by cutting the leaf. Cutting or shredding alters the physical properties (i.e., damages the waxy cuticle) and biochemical processes of the leaf and provides opportunities for microbial invasion of tissues. Studies show that *E. coli* O157:H7 is more likely than *Pseudomonas*, a predominant psychrotrophic spoilage microorganism that is able to grow at refrigeration temperatures, to become attached in the stomata and cut edges of the lettuce leaf (15). Studies on the survival and growth of *E. coli* O157:H7 in lettuce demonstrate that *E. coli* O157:H7 will decrease in numbers if stored at 39 - 41°F but increase at higher temperatures (2).

Contamination of leafy greens with pathogens can occur in the field, cooling facilities, packing houses, processors, transport vehicles or food establishments. Regardless of where or how contamination occurs, refrigeration at 41°F (5°C) or less in food establishments will prevent the growth of pathogens that may be present on cut leafy greens (1, 10, 11,17). Storage of leafy greens at temperatures above 41°F (5°C) may allow surviving pathogens to multiply and counteract pathogen reductions that may result from prior washing in cold or warm (13) water containing chlorine or other disinfectants. Refrigeration at ≤ 41°F (5°C) not only limits the growth of bacterial pathogens, but has also been shown to result in the inactivation of certain pathogens over time. Collectively, the implementation of Good Agricultural Practices (9), Good Manufacturing Practices (16) and proper temperature control for safety (TCS) at the point of sale or service (7), will mitigate the impact of any contamination that does occur.

Sensory panels and experiences from recent lettuce and spinach outbreaks show that the sensory quality of fresh and bagged, fresh-cut leafy greens lasts at least a week after the “sell by” or “use by” date and often much longer (3). The anticipated shelf life

¹ The 2009 Food Code defines “cut leafy greens” as fresh leafy greens whose leaves have been cut, shredded, sliced, chopped, or torn. The term “leafy greens” includes iceberg lettuce, romaine lettuce, leaf lettuce, butter lettuce, baby leaf lettuce (i.e., immature lettuce or leafy greens), escarole, endive, spring mix, spinach, cabbage, kale, arugula and chard (7). The term “leafy greens” does not include herbs such as cilantro or parsley. Lettuce and other leafy greens cut from their root in the field with no other processing are considered raw agricultural commodities (RACs) and are not included in the definition of “cut leafy greens” and are therefore not considered a PHF/TCS Food, as defined and applied in the 2009 Food Code.

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for many bagged, fresh-cut leafy greens is approximately 12-16 days. Spoilage microorganisms, mostly aerobes that normally act as indicators of time and temperature abuse to consumers, do not necessarily outgrow and spoil cut leafy greens before pathogens increase at abuse temperatures. This means that while pathogens may grow in numbers, the leafy greens still look visually acceptable to consumers.

Proper storage and handling of cut leafy greens

The 2009 Food Code contains a number of provisions that apply only to PHF/TCS foods, such as cut leafy greens. These provisions apply to commercially processed cut leafy greens, such as bagged salad mixes and spinach, and to leafy greens that have been cut “in-house” for sale or service to the consumer. These provisions are summarized here, along with suggestions for their application and verification in jurisdictions that have adopted these provisions.

Receiving

Cut leafy greens must be received at a temperature of 41°F (5°C) or less and be free of evidence of previous temperature abuse (3-202.11).

- This requirement does not apply to the receipt of whole heads of lettuce and other raw agricultural commodities.
- Refusal of products containing cut leafy greens when proper temperatures can not be assured is one way of achieving compliance with this requirement.
- Suppliers of commercially-processed, cut leafy greens generally recommend transport and storage of their product at temperatures below the 41°F (5°C) limit established in the Food Code.

Storage and Display

Cut leafy greens must be maintained at temperatures of 41°F (5°C) or less during cold storage and display (3-501.16).

- To verify proper cold holding, measure the product temperature using an appropriate temperature measuring device. A thin probe thermocouple can be inserted in thicker stem portions of the leaf for a valid reading. An infrared (IR) thermometer can also be used to measure the surface temperature of the leaves. IR thermometers may not be as accurate in measuring the temperature of bagged product as the packaging material can cause reflections of the IR beam. For sealed bags of product, insert a thermometer stem or thermocouple probes between bagged products or fold the bag tightly around the probe to ensure adequate contact with the product.
- Refrigerators and cold storage units in which cut leafy greens are stored should be equipped with air temperature monitoring devices that allow them to be checked for proper operation and temperature control.

If fresh leafy greens are cut or chopped within the food establishment, the cut product must be discarded if not sold or served within 7 days of the time the product was cut

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(3-501.18). The product must be marked to indicate the date by which disposal is required, unless the cut product is held less than 24 hours from the time it was cut. (3-501.17)

If a container of commercially processed and packaged cut leafy greens is opened in a food establishment, the product must be discarded if not sold or served within 7 days of the time the package was opened (3-501.18). The product must be marked to indicate the date by which disposal is required, unless the product is held less than 24 hours from the time the container is opened. (3-501.17)

Time as a Public Health Control

Time alone, without temperature control, may be used as a public health control for the storage or display of cut leafy greens for a limited period if written procedures are developed and the required conditions are met (3-501.19).

- If a food establishment lacks the equipment necessary to maintain the required temperatures of cut leafy greens, the development of procedures for the proper use of time as a public health control may represent a viable alternative to temperature control. For example, establishments that offer cut leafy greens on a buffet unit or a sandwich fixing station may wish to establish a procedure for tracking the time that cut leafy greens are held outside of temperature control and for disposing of product within a 4 hour limit.

Recommendation:

To reduce the risk of pathogen growth, maintain cut leafy greens at 41 ° F (5 °C) or less during storage and display. Routinely monitor the temperature of the product and the equipment used to maintain product temperature.

References:

1. Abdul-Raouf, U.M., L.R. Beuchat, and M.S.Ammar. 1993. Survival and Growth of *Escherichia coli* O157:H7 on Salad Vegetables, Appl. Env. Microbiol. Vol. 59, pp. 1999-2006.
2. Aruscavage, D., K. Lee, S. Miller and J.T. LeJeune. 2006. Interactions Affecting the Proliferation and Control of Human Pathogens on Edible Plants. J. Food Sci. 71(8), R89 – R99
3. CA DHS/US FDA. 2007 Investigation of an *Escherichia coli* O157:H7 Outbreak Associated with Dole Pre-Packaged Spinach. Available at <http://www.cdph.ca.gov/pubsforms/Documents/fdb%20eru%20Spnch%20EC%20Dole032007wph.PDF>
4. Chua, D., K. Goh, R.A. Saftner and A.A. Bhagwat. 2008. Fresh-Cut Lettuce in Modified Atmosphere Packages Stored at Improper Temperatures Supports Enterohemorrhagic *E. coli* Isolates to Survive Gastric Acid Challenge, J. Food Science. 73(3):M148-M153.

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5. Delaques, P., S. Stewart, S. Cazaux and P. Toivonen. 2002. Survival and Growth of *Listeria monocytogenes* and *Escherichia coli* O157:H7 in Ready-to-Eat Iceberg Lettuce Washed in Warm Chlorinated Water, J. Food Protect. (65)3: 459-464.
6. DHHS/FDA. August 22, 2008. Irradiation in the Production, Processing and Handling of Food, 21 CFR Part 179. Docket No. FDA-1999-F-2405-0005, available at <http://www.regulations.gov/search/Regs/contentStreamer?objectId=09000064806d2f95&disposition=attachment&contentType=html>
7. FDA Food Code. 2005 and 2007 Supplement. Available at <http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodCode/FoodCode2005/default.htm>
8. FDA Foodborne Pathogenic Microorganisms and Natural Toxins Handbook, *Escherichia coli* O157:H7 and factors affecting microbial growth in foods, available at <http://www.fda.gov/Food/FoodSafety/Foodbornellness/FoodbornellnessFoodbornePathogensNaturalToxins/default.htm>
9. FDA Guide to Minimize Microbial Food Safety Hazards of Fresh-Cut Fruits and Vegetables, available at <http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/ProduceandPlanProducts/UCM064458>
10. FDA Survey of Imported Fresh Produce, FY 1999 Field Assignment, available at <http://www.fda.gov/Food/FoodSafety/Product-SpecificInformation/FruitsVegetablesJuices/GuidanceComplianceRegulatoryInformation/ucm118891.htm>
11. Koseki, S. and S. Isobe. 2005. Prediction of pathogen growth on iceberg lettuce under real temperature history during distribution from farm to table. Int. J. of Food Microbiol. (104) 239-248.
12. Institute of Food Technologists. 2001. Evaluation and Definition of Potentially Hazardous Foods. Available at <http://www.fda.gov/Food/ScienceResearch/ResearchAreas/SafePracticesforFoodProcesses/ucm094141.htm>
13. Li, Y., R.E.Brackett, J. Chen and L.R Beuchat. 2001. Survival and Growth of *Escherichia coli* O157:H7 Inoculated onto Cut Lettuce Before or After Heating in Chlorinated Water, Followed by Storage at 5 or 15°C, J. Food Protect. (64)3: 305-309.
14. Palumbo, M.S., J.R. Gorny, D.E. Gombas, L.R. Beuchat, C.M.Bruhn, B. Cassens, P. Delaquis, J.M. Farber, L.J. Harris, K. Ito, M.T. Osterholm, M. Smith and K. M.J. Swanson. 2007. Recommendations for Handling Fresh-cut Leafy Green Salads by Consumers and Retail Foodservice Operators. Food Protection Trends, 27(11): 892-898.
15. Takeuchi, K. and J.F. Frank. 2000. Penetration of *Escherichia coli* O157:H7 into Lettuce Tissues as Affected by Inoculum Size and Temperature and the Effect of Chlorine Treatment on Cell Viability. J. Food Protect. 63(4): 434-440.
16. U.S. Code of Federal Regulations. 2008. 21 CFR Part 110 Current Good Manufacturing Practice in Manufacturing, Packing, or Holding Human Food. Available at <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfCFR/CFRSearch.cfm?CFRPart=110>

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17. USDA/AMS Microbiological Data Program Progress Update and 2005 Data Summary, available at <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=MDPSUMM05> and the 2008 Data Summary , available at <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5079908>
18. Wachtel, M.R. and A.O. Charkowski. 2002. Cross-Contamination of Lettuce with *Escherichia coli* O157:H7, J. Food Protect. (65)3: 463-470.