

The Temperature Danger Zone

by Chef Bob McGuire, C.C.

In all of nature, there is a range of temperatures where bacteria thrive and all the organisms that cause foodborne illnesses find conditions favorable for fast multiplication. It is the large populations of these organisms that cause us to become ill and cause the serious illnesses that kill over 5,000 people every year in this country (CDC.gov, 2011). According to studies conducted over the last ten years, **over 76 million incidents of foodborne illness were reported every year in this country**, but the number of unreported incidents is significantly higher than that. Over 325,000 people required hospitalization resulting from these causes. There are over 200 known diseases that are transmitted through food and several of the most serious ones were not even recognized just 20 years ago.

This temperature range is called the “temperature danger zone” because all the organisms responsible for foodborne illness thrive in that temperature range. The range is between 41° and 135°, and food left in that range becomes more and more toxic as time goes by. A lot of other factors come into play, such as acidity, moisture, ingredients and so on. For instance, if I had a tray of dried bread crumbs sitting out at room temperature, it may take several days before the level of organisms rose to the level of being toxic. But if I had a tray of scrambled eggs sitting out at room temperature the level of toxicity would quickly be reached in a number of hours.

There is a direct relationship between time and toxicity in all foods, but particularly in foods which are moist, have neutral acidity and are high in protein. So let’s take Aunt Sally’s wonderful potato salad with eggs, mayonnaise and a few bacon bits. She brings it to your cookout in one of her best serving bowls, covered with aluminum foil. It has been sitting on her kitchen table since she finished making it, around 30 minutes before she covered it, put it in her warm car and drove over to your house, roughly another 30 minutes away. By the time she sets it out on your buffet table, it has been at room temperature (or above) for an hour. Guests continue to drop by, have a drink, mingle and wait for the chicken to be grilled. Another hour goes by before everyone is ready to eat. They grab a plate, grab a piece of grilled chicken, stop by the buffet table and grab a spoonful of potato salad and the other room-temperature accompaniments and go sit at the picnic table in the sun to eat their meal.

The afternoon goes well, and nobody gets sick, yet. The guests all appear fine, until that evening, when many of them have bloody diarrhea, abdominal pain, cramps and a low-grade fever. Your guests have been poisoned by *Shigella*, transmitted either by insufficient or ineffective hand washing techniques, or that single fly in Aunt Sally’s kitchen. Usually, there would be no problem, but for over two hours, this bacteria was given the perfect opportunity for fast growth: time and temperature on Aunt Sally’s kitchen table, in her hot car, on your table and finally in the sun at the picnic table. This is a foodborne infection. You should immediately seek medical attention and for the next month you should be particularly diligent in washing your hands and keeping your environment free from contamination. You should not prepare food during this period. It takes this long for the infection to subside.

How could this have been avoided? Aunt Sally should have kept the potato salad in the refrigerator, covered, as soon as it was completed. It should have been placed in a cooler full of ice and left in the cooler until the last minute when it was to be served. Me? I would have placed the potato salad in a big, zip-top bag on ice (and covered with ice) in the cooler. I would have placed the bowl in a larger bowl full of ice before taking the potato salad out of the bag. This way, the potato salad would have remained under refrigeration for the whole time from

when it was made until it was consumed. It also would have kept it away from that pesky fly in Aunt Sally's kitchen.

Okay, so now Aunt Sally feels really bad about poisoning your guests. So she offers to make some chicken soup and to bring it over the next day. She makes the chicken stock, which cooks for 3½ hours, certainly long enough to kill any organisms, right? When it is done, she leaves it on the stove to cool for a couple hours, and then puts the whole pot into the refrigerator to finish cooling. She'll finish the soup the following morning. The next day, she skims off some of the congealed fat from the cooled stock and puts the whole pot back on the stove, adding vegetables and herbs. As soon as the stock comes to a simmer, she puts in some elbow macaroni and simmers it until done, then cools the soup on the stove for a couple hours and ladles some into plastic containers and makes her way over to your house (in the same hot car). She means well. She travels the same 30 minutes to your house with the soup.

Since the macaroni is perfectly cooked, you decide that you'll just reheat the soup in a saucepan and make some crusty bread to go with it. Your family and Aunt Sally have the soup for dinner and then she leaves. Later that night, you have severe abdominal pain and diarrhea, but no nausea and vomiting. You have been poisoned by Aunt Sally again, but this time it is because she didn't cool the food properly or fast enough, and didn't boil the stock when she was reheating it. She has given you a case of *Gastroenteritis* caused by *Clostridium Perfringens*.

The other cardinal sin Aunt Sally committed was to not cool things properly. When cooling food, you are required to cool the item (in this case the chicken stock) to 70° within 2 hours and then to 41° within the next 4 hours. Placing the pot in the refrigerator won't do it. It will just warm up the contents of the refrigerator placing them all at risk. She should have placed ice in the stock or sanitized frozen water bottles in the stock to cool it to 70°, then ladled it into smaller containers and placed it in the refrigerator to be to the required 41°. Since this takes time, she should have come over to your house the next day with ice cold soup (in a cooler full of ice). Then you could have reheated it at your place and nobody would have been sickened. You decide that Aunt Sally needs to take some cooking classes with Chef Bob.

Fortunately, the vast majority of these two types of incidents are not fatal, but some are. You have just become some of the 76 million people that are poisoned each year (over 208,200 every day!) and you have learned two valuable lessons. In both examples, there were critical control points where action could have been taken to avoid organism growth, but they were ignored. The protocol we follow in the commercial kitchen is called Hazards Analysis and Critical Control Points or HACCP for short. If you remember these two examples, you might help avoid some potentially serious repercussions. Think like an organism, take aggressive steps to avoid contamination, and take some classes if you're like Aunt Sally.