Biological Hazards

The biological hazards of meat and poultry products result from the presence of potentially pathogenic bacteria in and on the live animal or bird, including intestinal contents and exterior surfaces such as hide, hair, feathers, and hooves. Bacterial contamination of carcass surfaces is an unavoidable consequence of processing animals and birds into meat and poultry for human consumption. The types of bacteria present on the live animal or bird will largely determine the bacterial population that exists on the carcass surface. Consequently, products derived from carcasses will contain the same types of bacteria present on the carcass surfaces. The establishment faces a challenge, in that the raw processes do not commonly include a lethality step, a procedure that would eliminate the bacteria. These establishments must do their best to control or reduce the hazard, or to prevent it from entering the process.

The prevalence of the pathogen ***Salmonella*** in beef, lamb, pork, and poultry carcasses varies greatly. The overall contamination of meat and poultry carcasses with these pathogens depends not only on the numbers of the pathogens on the hair, feathers, skin, and in the intestinal tract of the animals, but is also significantly affected by the degree of cross-contamination occurring from these sources during slaughter and processing. Plant operators must adhere to pathogen reduction performance standards for Salmonella, as specified in 9 CFR 310.25 for livestock and in 9 CFR 381.94 for
poultry.

Escherichia coli is commonly found as part of the normal bacteria of the intestinal tract of humans and animals. Some strains, including ***Escherichia coli* O157:H7** can cause serious illness in humans. Cattle may carry Escherichia coli O157:H7 in the intestinal tract at the time of slaughter, although it is actually harmless to these animals. Beef has been implicated in a number of food borne illnesses associated with this pathogen. Contamination with *Escherichia coli* O157:H7 can be reduced through the use of sanitary dressing procedures during slaughter (dehiding and evisceration) and pathogen reduction intervention treatments (organic acid rinses, hot water rinses, and steam pasteurization). FSIS considers raw ground beef contaminated with *E. coli* O157:H7 to be adulterated, unless the ground beef is further processed to destroy this pathogen. FSIS samples and tests ground beef for *E. coli* O157:H7.

Raw poultry is the major source of ***Campylobacter***. Cross-contamination during preparation of raw chicken and the consumption of inadequately cooked poultry appear to be significant sources of this human illness. FSIS is conducting research about the prevalence of this organism. Current evidence is not conclusive about the risk, and FSIS does not regularly test for *Campylobacter*.

This chart summarizes the microbiological hazards in raw products, beef, lamb, pork, and poultry. Please note that an unusually high level of contamination or improper handling and storage may cause one or more of the pathogens to become a hazard in any species. Establishments may also choose to address other pathogens in their hazard analysis.

Process Categories	**Species**	**Biological Hazards, reasonably likely to be present and cause food borne illness, denoted by "+"**		
		Salmonella	*E. coli* O157: H7	*Campylobacter*
Raw-slaughter, not-ground, and ground	Beef	+	+	
	Lamb	+		
	Pork	+		
	Poultry	+		+

The following tables show examples for each of these biological hazards, the public health concerns associated with them, and some methods for controlling these biological hazards.

Salmonella

Disease symptoms	Causes infection (invasion of the lining of the intestine) with acute diarrhea, nausea, vomiting, abdominal cramps, chills, headache and fever. Occasionally, may cause blood stream infections and death. Frequency of death, 1-4%.
Source	Fecal contamination of meat and poultry.
Transmission	Primarily from consumption of raw or undercooked eggs, milk, meat and poultry. Infective dose can be as low as 15-20 organisms for immunocompromised individuals.
Controls	Sanitation, proper hygiene practices. Killed by mild heat, effective antimicrobial treatments are acetic and lactic acids, acidified sodium chlorite, trisodium phosphate, and hot water or steam.
Characteristics	• Grows at 41-115º F. • Grows with or without air. Optimum growth at human body temperature. Grows very poorly at refrigeration temperatures. • Survives well in frozen or dry foods.

Escherichia coli O157:H7

Disease symptoms	Causes infection with bloody diarrhea (hemorrhagic colitis). Produces a potent toxin in the intestinal tract of infected people. May lead to hemolytic uremic syndrome, resulting in kidney failure and death, especially in children. Mortality rate as high as 50% in elderly.
Source	Fecal contamination of beef.
Transmission	Consumption of raw or undercooked beef. Age and immunity status will impact infective dose. As few as 10 organisms may cause illness.
Controls	Prevention of cross-contamination. Killed by mild heat, effective antimicrobial treatments are acetic and lactic acids, acidified sodium chlorite, trisodium phosphate, and hot water or steam.
Characteristics	• Grows with or without air. • Grows at 45-121º F; optimum temperature for growth is human body temperature. • Grows in moist, low-acid foods.

Campylobacter

Disease symptoms	Causes a 2-5 day infection with diarrhea, fever, abdominal pain, nausea, headache, muscle pain. May lead to nerve damage. Rarely causes death.
Source	Fecal contamination of raw poultry
Transmission	Cross-contamination from poultry or consumption of undercooked food. Infective dose is 400-500 bacteria.
Controls	Sanitation, proper hygienic practices, effective antimicrobial treatments are acetic and lactic acids, acidified sodium chlorite, trisodium phosphate, and hot water or steam.
Characteristics	• Sensitive to heating, drying, disinfection, acid, and air. • Grows only in reduced oxygen environments • Grows at 86-113º F