* *Escherichia coli* is: Gram-negative bacteria, Non-spore forming rod, Facultative, ferments lactose, oxidase-negative. Non-pathogenic strains are part of normal intestinal flora
* Make a potent Shiga toxin that can attack the body in several areas: gut (causing bloody diarrhea), kidneys (causing kidney failure), nervous system
* The toxin can cause clots to form in small blood vessels. As red blood cells try to pass through the clots they get damaged (causing anemia).
* STEC can be deadly to humans, but no clinical illness seen in infected cattle.
* From 1990 to 2003, Center for Science in the Public Interest Outbreak Alert! found that:

Seafood caused 723 outbreaks and 8,071 cases of illness.

* Produce caused 432 outbreaks and 25,823 illnesses.
* Poultry caused 354 outbreaks and 11,894 illnesses.
* Beef caused 343 outbreaks and 10,872 illnesses.
* Eggs caused 309 outbreaks and 10,750 illnesses.
* Multi-ingredient foods, where the contaminated ingredient was not identified, were linked to 601 outbreaks and 18,006 illnesses.
* US produces 25% of world’s beef supply
* 11.2 B beef servings in American restaurants annually
* Per capita beef consumption in US = 70 lbs per year
* Most popular day for beef consumption in the US = Memorial Day
* Most popular form/cut of beef in the US = ground beef
* *E. Coli* Life Cycle
  + Primary habitat
    - Lower intestine
    - Nutrient rich, 37C, anaerobic, vigorous growth
  + Secondary habitat
    - Water, sediment, soil
    - Nutrient poor, 10-14C, can exceed 37C, aerobic & anaerobic, negative growth rate
* The following parties are responsible for food safety: Producers (pre-harvest), Processors (post-harvest), Distributors, Food Service professionals, Government regulators, Research groups, and Consumers.
* How will we control STEC? Objectives:

1. Detection
2. Biology
3. Interventions
4. Risk Analysis and Assessment
5. Risk Management and Communication

* Objective 1: Detection
  + Develop & validate tests for STEC-8
  + Design sampling protocol for cattle & beef
  + Implement technologies for sampling at all stages
  + Develop better sensors
* Objective 2: Biology
  + Characterize strains of STEC
  + Identify modifiable risks to limit outbreaks
  + Determine presence of STEC
* Objective 3: Interventions
  + Develop & validate interventions for cattle, hides, carcasses, ground, & non-intact beef
  + Compare energy, water, and economic cost/benefits of interventions
* Objective 4: Risk Analysis/Assessment
  + Create risk models for STEC contamination
  + Validate corrective actions
* Objective 5: Risk Management & Communication
  + Translate research into user-friendly food safety materials
  + Provide & promote useful risk assessment participation & understanding
  + Develop & deliver STEC materials for food safety professionals, regulators, educators, and consumers.

Interventions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Live Cattle** | **Carcass** | **Trim** | **Whole Muscle Subprimal** | **Processed Meat** |
| **Biological** |  |  |  |  |  |
| Vaccine | X |  |  |  |  |
| Bacteriophage | X |  |  |  |  |
| Direct-fed microbials | X |  |  |  |  |
| Probiotics |  |  |  |  | X |
| **Chemical** |  |  |  |  |  |
| Acid washes | X | X |  | X |  |
| Neomycin | X |  |  |  |  |
| Chemical de-hairing |  | X |  |  |  |
| Ammoniation |  |  | X |  |  |
| Controlled phase CO2 |  |  | X |  |  |
| Nitrates |  |  |  |  | X |
| **Physical** |  |  |  |  |  |
| Hide washing | X |  |  |  |  |
| Hot water wash |  | X |  |  |  |
| Steam pasteurization |  | X |  |  |  |
| Steam vacuum |  | X |  |  |  |
| Trimming |  | X |  |  |  |
| High pressure processing |  |  | X |  |  |
| Refrigeration |  | X | X | X | X |

Persuasive essay – See appendix NeSA Performance Level Descriptors.pdf

FATTOM

* + An acronym to help us remember the factors affecting the growth of microorganisms: Yeast, Mold, and Bacteria
* Why FATTOM?
  + To keep microorganisms out of our food!
  + To control the growth of existing microorganisms.
* FATTOM
  + F is for Food
    - Yeast – prefer simple sugars
    - Mold – can grow in very poor nutritional conditions
    - Bacteria – prefer protein-based foods
  + A is for Acid
    - Bacteria, yeast, and mold grow best in neutral conditions (pH = 7)
    - Molds grow at a lower pH (acidic) than yeasts and bacteria
    - Bacteria will not grow at pH < 4.6
  + T-T is for Time and Temperature
    - Microorganisms need time to reproduce
    - Lower temperatures inhibit reproduction
    - Keep cold foods cold until cooking and hot foods hot once cooked.
    - Do not keep foods in the danger zone for more than a few minutes.
    - Class: What is the danger zone for beef?
  + O is for Oxygen
    - Molds are aerobic
    - Yeasts are facultative anaerobic
    - Bacteria are aerobic, anaerobic, and facultative
    - Class: Is controlling oxygen levels a good way to control bacteria?
  + M is for moisture
    - All microorganisms need moisture to grow & reproduce