241 Developing Validation Models for E. Coli 0157 Inactivation in Dry Fermented Sausages. Shai Barbut* and Mansel Griffiths, [1]*University of Guelph*.

After the 1994 E. coli 0157:H7 outbreak associated with the consumption of semidried fermented sausage in Washington State, the USDA-FSIS has required processors to either validate their processes or include a step that will assure a 5 log reduction of the pathogen. The presentation will illustrate the work done in our laboratory to validate sausage fermentation (i.e., inoculated studies) for different commercial processes, and the initial development of three models to validate the process when the USDA-FSIS two log E. coli reduction option is chosen. The models include variables such as water activity, pH, fermentation and drying time, as well as the interactions among these variables. The predictive abilities of the models were confirmed by linear regression, comparing values for E. coli survival derived from the models with experimental values obtained from data that were not used to construct the models. Response surface diagrams were also produced to demonstrate the effects of the different variables.

Key Words: Fermented Sausage, E. Coli 0157, Validation models

242 Use of carbon monoxide in retail meat packaging. O. Sorheim*[1], H. Nissen[1], T. Aune[2], and T. Nesbakken[3], [1]*MATFORSK - Norwegian Food Research Institute, Aas, Norway*, [2]*Norwegian School of Veterinary Science, Oslo, Norway*, [3]*Norwegian Meat Research Centre, Oslo, Norway*.

Centralised pre-packaging of fresh retail meat in modified atmospheres is common in many countries in Europe, but to a less extent in the USA. The predominating gas mixture for retail meat contains appr. 70 % O2 and 30 % CO2 enabling an extended, but still limited shelf life. Carbon monoxide (CO) binds strongly to myoglobin and maintains a bright red color of meat. The Norwegian meat industry has for 15 years been using a gas mixture of appr. 0.3 - 0.5 % CO, 60 - 70 % CO2 and 30 - 40 % N2 (CO mix). The market share of pre-packaged retail meat in the CO mix in Norway is 60 %. CO is presently not permitted for meat packaging in the EU or USA. However, CO is temporarily allowed in Norway, and an application for permanent use in the EU and Norway is under evaluation. Research on aspects of the CO mix has demonstrated several benefits. Consuming meat exposed to the CO mix does not pose a toxic hazard, because the meat contains only negligible amounts of CO. The CO mix is safe to use in meat plants, as the CO is delivered in a concentration of maximum 1 %. The combination of a stable, bright red color and a long microbiological shelf life of the meat is unique for the CO mix. The shelf life extension is achived by the high CO2 concentration and absence of O2. Growth of Yersinia entercolitica, Listeria monocytogenes and Escherichia coli O157:H7 was more inhibited by the CO mix than other packaging methods. Ground beef containing carboxymyoglobin required a higher temperature by cooking to develop a gray, well-done color than other forms of myoglobin. The main reason for resistance against CO relates to its ability to mask spoilage by color stabilization beyond the time of microbiological deterioration. A reliable shelf life of MAP meat can only be obtained through proper quality control of meat handling, packaging and chill chain.

Key Words: Carbon Monoxide, Packaging, Retail Meat

243 Use of the AMI Process Lethality Spreadsheet to Validate the Safety of Cooking Procedures. T. A. Freier*, *Cargill*.

Producers of cooked meat and poultry products are increasingly being required to produce documented, science-based validations of thermal processes. Traditional thermal death-time studies require relatively extensive laboratory facilities, time and expertise. When D and Z values are known (through experimentation or by obtaining published values), there remains the question of how to apply these variables to an actual thermal process. The American Meat Institute Foundation (AMIF) has sponsored the development of a process lethality spreadsheet that can be used to estimate the effectiveness of specific heat processes in destroying microorganisms of concern. This model is readily available for downloading from the AMIF's web site. With the input of the proper variables, this spreadsheet can quickly indicate the total kill potential of a specific cooking process for any of the common food-borne pathogens of concern. This presentation will provide a practical introduction to the use of this model and will discuss the appropriate use of the data that is generated.

Key Words: Thermal Process, Computer Model, Critical Control Point Validation

244 Predictive models for growth of foodborne pathogenic spore-formers at temperatures applicable to cooling of cooked meat. Vijay Juneja*[1], [1]*USDA-ARS-ERRC*.

Inadequate cooling of foods in retail food operations is a major safety problem. Accordingly, the objectives of these studies were to determine a safe cooling rate for cooked beef and develop models to predict the germination, outgrowth and lag (GOL), and exponential growth rates (EGR) of Clostridium perfringens and Clostridium botulinum from spores. First, we demonstrated the effectiveness and validity of "square-root model" under non-isothermal conditions. Next, we developed two models, one each for C. perfringens and proteolytic C. botulinum, to predict their growth from spores at temperatures applicable to the cooling of cooked meat. It was found that for C. perfringens, the use of the logistic function provided a better prediction of relative growth than the use of the Gompertz function. For C. botulinum, growth curves were determined by fitting Gompertz functions to the data. From the parameters of the Gompertz or logistic function the growth characteristics, GOL times and EGR, were calculated. These growth characteristics were subsequently described by Ratkowsky functions using temperature as the independent variable. By applying multivariate statistical procedures, the standard errors and confidence intervals were computed on the predictions of relative growth for a given temperature. Closed form equations were developed that allow prediction of growth for a general cooling scenario. The predictive models should aid in evaluating the safety of cooked product after cooling and thus, with the disposition of products subject to cooling deviations.

Key Words: Predictive models, Spores, Cooling of cooked meat

245 Case ready red meat–demand and technology. Scott Eilert*[1], [1]*Excel Corporation*.

The demand for case ready red meat continues to grow at a pace unmatched in previous years. Suppliers of red meat are focusing a great deal of their growth around meeting these demands and providing solutions for retailers. The demand is being fueled by several factors, most notably the need to reduce labor and costs at the retail outlet. As the retail market is quite diverse (volumes, distribution methods, product lines, branding) so are the solutions that are required by retailers. There is no one ideal business or packaging model for case ready today. The proper solution for a retailer will vary with the factors listed previously. The goal of this presentation will be to present the various models of case ready, primarily focusing on the packaging formats that can be employed. Specifically, the various high oxygen and low oxygen formats will be presented. The advantages and disadvantages of each format will be discussed. In closing, this presentation will address key technological challenges as the industry moves to more central processing of red meat products for retail.

Key Words: Case Ready, Packaging, Read Meat