responsible use of antibiotics in cattle. Therapeutic use of antibiotics is used to reduce effects of clinical diseases in cattle, including potential human pathogens such as salmonellae. Additional information is needed regarding advisability of some currently accepted practices, especially when considering human health risks (Rings, 1985; Kennedy and Hibbs, 1993).

Animal Identification

The beef and dairy industries, along with state and federal agencies, must continue to develop adequate means to identify animals from the initial production unit through the slaughter process. Permanent animal identification is essential so producers can assume further responsibility for the beef they market by being able to track animals through the entire production, slaughter, wholesale, and retail processes. Currently, mature animals are identified by backtags as part of the Brucellosis eradication program. Retention of this portion of the program is suggested until better means of identification are implemented. Permanent identification is a critical issue for improving the safety of raw beef at the producer level.

Projected Needs: Current and future strategies that may be useful in decreasing the risk of microbial contamination at production levels include assessments of the prevalence of human pathogens in cattle, permanent identification of animals using advanced technology (USAHA, 1992; Maher 1991; Nelson, 1991), use of new and improved vaccines, use of improved management methods in reducing microbial contamination risk, and incorporation of biotechnological advances in cattle production as they are proven to be beneficial in minimizing or preventing microbial contamination.

Producers should be encouraged to carefully review production methods and HACCP guidelines to decrease risks associated with pathogenic microbial contamination (Smith and House, 1992). Utilization of quality management principals is recommended since these concepts will result in improved quality assurance and pre-harvest food safety programs (Schmitz, 1993; FAPMC, 1992; AVMA, 1992). Implementation of production practices suggested by these programs are critical at all phases of cattle production regardless of unit size or type.

B. Slaughter Operations

Unit operations associated with the slaughter and dressing of beef are summarized in Figure 1. A more

detailed examination of each of the steps is provided in ATTACHMENT D.

À CCP within a Hazard Analysis and Critical Control Point (HACCP) program is defined as any point, step, or procedure at which control can be applied and a food safety hazard can be prevented, eliminated, or reduced to acceptable levels (NACMCF, 1992).

Seven specific CCP process steps have been designated in the processing of raw beef (Figure 1 and Table 1). These include (1) skinning, (2) post-skinning wash/bactericidal rinse, (3) evisceration, (4) final wash/bactericidal rinse, (5) chill, (6) refrigerated storage, and (7) labeling.

For each of these CCP steps critical limits are defined for proper control. These CCPs must be monitored at a frequency sufficient to ensure process control. Corrective actions to be taken when CCPs do not meet critical limits should be specified clearly in the HACCP plan. This should include the priorities of actions to be taken and the individuals to be notified of the deviation. The HACCP system should be verified according to HACCP principle #7 (NACMCF, 1992).

The seven CCPs with procedures associated with the processing step are shown in the following outline.

Implementation and Management of HACCP Critical Control Points

CCP 1: Skinning

The hide is the first major source of microbial contamination on fresh beef carcasses. Cattle leaving the farm, feed lot, or sales barn for delivery to the slaughter plant, carry with them microbial populations indicative of what occurred during the care and handling of the live animal. Salmonella and other types of bacteria can be spread during the skinning process through contact with hide, hands and various pieces of equipment (Empey and Scott, 1939; Newton, et al., 1978; Stolle, 1981; Grau, 1987). Current skinning technology does not provide a means for destroying enteric pathogens that reside on the hide of animals coming to slaughter. There also is no available means to remove all soil from the hide of animals prior to slaughter; however, preslaughter washing does have a positive effect (Empey and Scott, 1939; Dixon, et al., 1991). Skinning, therefore, should be done in a manner that will minimize cross-contamination from the hide to the carcass. This contamination can be minimized by pulling the hide down and out from the carcass as opposed to upward and away. In addition, equipment and carcass contact surfaces must be properly

cleaned and sanitized. The operator performing the skinning process must be trained to minimize contamination. Management must reinforce the proper techniques through adequate supervision.

The effectiveness of the CCPs outlined in this document are based on the concept of additive impact. Wash and bactericidal rinse steps will significantly reduce the level of microbial contamination resulting from the skinning or evisceration steps; however, the efficacy of these processes are dependent on control of skinning and evisceration. The procedures and corrective actions outlined for CCP 1 and CCP 3 minimize the level of contaminating material that must be removed by the wash and rinse steps.

If critical limits for CCP 1 are exceeded, corrective actions must be taken prior to the carcasses being subjected to the post-skinning wash and bactericidal rinse. Corrections of CCP 1 deviations can be achieved by adding additional operators to the skinning procedure, reducing the chain speed in the skinning area, and/or conducting carcass trimming prior to the postskinning wash and bactericidal rinse.

CCP 2: Post-Skinning Wash and Bactericidal Rinse

During the skinning process, newly exposed carcass surfaces can become contaminated with dressing defects, i.e., fecal material, hide and/or dirt, that may introduce bacterial pathogens. A postskinning wash and bactericidal rinse is an effective means of reducing this contamination. Any pathologic conditions, i.e., abscesses, septic bruises, etc., should be removed prior to CCP 2.

Maximum benefit of post-skinning wash and bactericidal rinse can be achieved if the amount of contaminating material is minimized, emphasizing the importance of CCP 1 (skinning). Proper skinning procedures must be achieved for effective post-skinning wash and bactericidal rinse.

Post-skinning wash and bactericidal rinse should occur as soon after skinning as possible to limit irreversible attachment of pathogens to the carcass. An in-line, post-skinning, potable water wash at 90-100°F and a pressure of 345–2070 kPa (50–300 psi) removes much of the visible surface contamination (hair, specks) and reduces microbial contamination to some extent (DeZuniga, et al., 1991). The water wash should be followed immediately by a bactericidal rinse to provide an effective reduction of surface bacteria. The bactericidal rinse should be an approved antimicrobial agent such