LOHMANN ANIMAL HEALTH INTERNATIONAL

SALMONELLA ENTERITIDIS

Introduction:
Salmonella enteritidis (SE) was first isolated from poultry in 1935. Since that time, SE has become a serious human health and poultry disease worldwide. From 1968 to 1973 SE isolates accounted for 9 percent of the salmonella isolates from poultry in England and Wales and then only 1-2 percent the period of 1976 to 1985. It was only in 1986 that SE was recognized as a frequent and serious pathogen of poultry in Great Britain. *Salmonella enteritidis* has been a major concern in the US starting in the 80's. Research has been conducted to determine the course of the disease in poultry, how the organism spreads, how the organism survives in the environment and the transmission of SE from poultry leading to human health problems.

Etiology:
Salmonella enteritidis is a gram-negative bacterium in the Enterobacteriaceae family. It is not host specific and has been found to be carried by rodents, birds and a variety of animals, and insects. Using the Kauffmann-White scheme, SE is a serogroup D salmonella.

Disease:
Since the early 80's, *Salmonella enteritidis* has become an important disease for the poultry industry worldwide. Although SE infections in hens usually goes undetected, it can cause decreased egg production and in Latin America and Europe it has been associated with morbidity and mortality in layers, breeders and broilers. In Europe some strains can produce 20% mortality in poultry flocks in addition to human illness, attributed to the transovarian transmission. In the US, particularly the Northeast, egg borne human health risk is the main concern, while disease in chickens has not been a concern. SE Prevalence rate in contaminated eggs ranges from 0.03% to 0.9% in the US and UK. The difference in the disease presentation may be due to the phage types present in an area and management practices. Phage type 4 is the most common type in Europe, in the US types 8, 13a, 14b and 23 are the most common types. A phage is a bacteria virus. Phage type refers to the specific phage that can infect an SE isolate. Phage typing helps identify SE isolates and provides information for epidemiological studies of outbreaks. SE phage type in eggs causing human health problems have been found to be the same type in mice and the environment of infected flocks. Most SE outbreaks from eggs have been associated with improper storage, handling and preparation. The single most effective way to prevent SE outbreaks, attributed to the consumption of eggs, is proper handling - processing and shipping them quickly, storing them at or below 45° F and not serving cooked eggs with utensils or cookware used to prepare them when raw.

SE can survive in the environment in feces, liter and dirt for months and perhaps years. SE growth is inhibited at 40° F and lower and SE is killed at 140° F and higher. Common water supply and proximity of contacts play a role in horizontal spread. Mice and other rodents are probably the main reservoir of SE. SE can infect a number of different animals and can even be spread by insects. This makes eradication a difficult and potentially an unachievable goal. Most primary breeders and multipliers are free of SE, but SE contamination can still occur if birds are placed onto contaminated farms or due to breaks in biosecurity. With increasing age of birds the ability of SE to penetrate the intestinal mucosa falls rapidly. Contamination of eggs occurs for a short period once a flock is contaminated. Younger flocks tend to produce a higher rate of SE contaminated eggs. Stress (feed and water withdrawal, etc.) on birds increases shed rate of SE.

Prevention:

There are many steps in the prevention and control of *Salmonella enteritidis.* Since SE can be carried by a number of animals and it's relative stability in the chicken house environment, control must include several different processes. The major areas of concern are cleaning and disinfection, rodent control and biosecurity. Most animals including rodents, predators, wild birds, flies and other insects can carry SE. Rodents tend to be most susceptible to SE and must be controlled to prevent introduction into the chicken house. Rodents serve as the number one method of SE spread between flocks and the contamination of newly placed flocks.

Poultry houses need to be tested to determine if SE is present in the environment. Drag swabs have proven to be very good at detecting SE on a farm. Positive farms must be thoroughly cleaned and disinfected between flocks. Prior to repopulating the farm, the environment should be tested again to assure the house is free of SE. Once a house is clean every effort possibly should be made to prevent reintroducing SE. This would include repopulating with chicks from negative breeder stock. SE can be introduced in contaminated feed, water and air. Company personnel traveling from farm to farm must be careful to not introduce SE on their feet, hands and clothing. Dust, feathers, manure, equipment and supplies can all physically carry SE onto a clean farm. If items are moved from farm to farm, they should be cleaned and disinfected to prevent the possibility of carrying SE. The practice of mixing stock should be evaluated for the potential hazards of contaminating a premise.

By cleaning and disinfecting, and practicing good biosecurity, we can help control SE; unfortunately, it is probable contamination of the flock will still occur on the farms. To help prevent problems if SE is reintroduced onto a farm, vaccination with a bacterin is recommended. Use of bacterins has been proven to prevent gastrointestinal, internal organ and reproductive organ colonization. By preventing colonization, the chance for SE to heavily contaminate an environment after introduction is very small. Studies have shown that multiple house farms that use bacterins remain negative for SE while non-vaccinated houses on the same farm turned positive within ten weeks of housing. Vaccination should occur prior to exposure to SE. This will help decrease the carrier state in birds resulting in intermittent shedding of SE into the environment. Vaccination in birds already exposed to SE may help reduce fecal shed, cycling in the flock and

contamination of the environment. Furthermore, it will help prevent the number of contaminated eggs and occurrence of disease in the flock.

Inacti/Vac SE4 protects birds from intestinal colonization. In challenge studies, vaccinated birds shed SE only for the first 24 hours as SE bacteria pass through the intestinal tract, unable to colonize the protected mucosal layer. Intestinal culture results confirm that vaccination controls colonization. At 14 days post challenge, intestinal tract culture results reveal 100% protection against colonization. In contrast, SE colonized the intestinal tract of non-vaccinated birds after oral challenge. Subsequently, SE multiplication in the intestinal tract leads to increased fecal shed. When this occurs in a flock, the increased fecal shed allows the house to be seeded down with SE and birds are continuously exposed to the organism. Beyond decreasing environmental contamination, protection of the intestinal tract decreases the chance of eggshell contamination.

SE vaccination also helps decrease internal egg contamination by protecting the reproductive tract from SE colonization. Inacti/Vac SE4 has been shown to be 100% protective against reproductive tract colonization following IM challenge with over one million SE bacteria. Following oral challenge with more than 10 million SE bacteria, Inacti/Vac SE4 provides 97% protection. Although this method of challenge is much more severe than field exposure it does demonstrate the high level of protection offered by Inacti/Vac SE4.

Lohmann Animal Health has studied phage type cross protection. Our research demonstrates that cross protection exists between phage types. Independent researchers have confirmed these studies; but we did not stop there. We conducted many experiments with various single and multiple isolate vaccines to decide which gives the best protection. To provide optimum protection, we have incorporated four specific phage types into Inacti/Vac SE4. This combination provides antigenic diversity to protect your flock from its specific field challenge.