Horizontal transmission was lowest in cages followed by slats. Floor systems were the most likely to support horizontal transmission between shedder hens and susceptible contacts.

The rates of recovery of *Salmonella* Enteritidis from tissues following infection or from contact hens were extremely low. This is consistent with previous literature reports which show ranges of 2.5% to 7% recovery following administration of large doses of *Salmonella* Enteritidis (10⁹ cfu/ml) which is far in excess of what might occur under commercial housing conditions.

The fact that hens appear relatively resistant to intestinal colonization and extension to organs following controlled infection suggests that protection can be enhanced by durable immunization and administering combinations of prebiotics and probiotics in feed. It is hoped that the research team at the Richard B. Russell Agricultural Research Center will review these aspects of protection in subsequent studies since this would have profound commercial implications.

The significance of this article is that it refutes the conclusions derived from studies in Europe that implicate cages as a risk factor for SE infection in comparison to floor systems.

**Addressing the Challenges of Alternative Housing Systems for Poultry**

The Poultry Site, November 2011

'Alternative Systems for Poultry – Health, Welfare and Productivity', organised by the UK Branch of the WPSA

**Development of Furnished Cages for Laying Hens**

"Directive 99/74/EC has made the biggest impact on animal welfare in the EU in the shortest time," said Arnold Elson of ADAS Gleadthorpe in the UK in the introduction to his presentation, which was prepared with Dr Ragnar Tauson of the Swedish University of Agricultural Sciences.

The majority of hens have been – or will be – moved to furnished cages (FC) as a result of the Directive, which comes into effect on 1 January 2012, he said, increasing production costs. In fact, FC were conceived more than 30 years ago when welfare deficiencies of barren conventional cages were realised. Their use was intended to enhance hens' behavioural repertoire and welfare without the disadvantages of non-cage and extensive housing.

Since then, their design has been refined and improved, resulting in much improved performance and hen welfare. With 750 square centimetres per bird, FCs offer hens more space than conventional cages, as well as perches, nest boxes and a scratching area, in addition to the feed trough and drinkers.
Group size has been an important consideration, said Mr Elson, especially in relation to variation in damaging pecking in differing genotypes, with or without beak treatment. Regulations on beak trimming vary from country to country and have affected cage design, group size and management.

The trend has been to move from small group FCs – used mainly in Scandinavia – to larger group medium and large FCs subsequently developed in other countries, with the majority of birds in groups of up to 60 birds. FCs are have been estimated to increase production costs by about eight per cent over conventional battery cages.

The group sizes have generally performed well under good management, said Mr Elson. Interventions such as beak trimming and controlled light intensity are most often applied in FCLs and to brown genotypes.

Large-scale studies, in which performance and welfare have been compared across all currently available systems, enable us to conclude that they are at least as good in FCs as in any other system and probably superior.

Council Directive 19999/74/EC, which requires the demise of all conventional cages in the EU by January 2012, has accelerated the move into FCs and it is clear that the majority of laying hens in Europe will be housed in them for the foreseeable future, with the aim of enhancing laying hen welfare.

FCs have potential for further development as research reveals more information of optimum group/cage sizes, the provision of litter, the elimination of red mites and ways to reduce feather pecking and cannibalism, concluded Mr Elson.

**Comparison of Production, Health and Welfare of Hens in Cages and in Alternative Systems**

'Alternative Systems for Poultry – Health, Welfare and Productivity', organised by the UK Branch of the WPSA

Bas Rodenburg of Wageningen University in the Netherlands made the focus of his paper a comparison of the performance, welfare, health and hygiene of laying hens in different types of non-cage systems, focusing on barn, free-range and organic systems. In a paper written with Drs K. De Reu and F.A.M. Tuyttens of the Belgian Institute for Agricultural and Fisheries Research, he contrasted non-cage systems with each other and with cage systems. He concluded that large differences have been identified, both between and within systems.

Moving from conventional cages to furnished cages, barn, free-range and organic systems results in increasing environmental complexity, he said, which is positive for some aspects of hen welfare but also increasing risks for performance, health and hygiene, which may be negative for other aspects of...